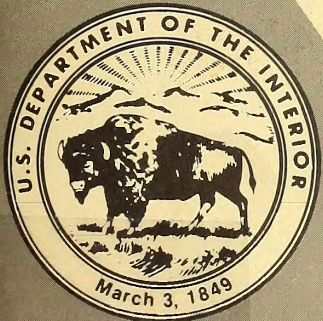
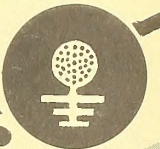


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THE NEED FOR A NATIONAL SYSTEM OF TRANSPORTATION AND UTILITY CORRIDORS



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ABSTRACT

At the request of Congress, the Department of the Interior, Bureau of Land Management (BLM), studied the necessity and desirability of establishing a national system of transportation and utility corridors across Federal lands. Because of the high percentage of Federal lands and the concentration of indicated future right-of-way needs there, the study focused on lands west of the 100th Meridian (the approximate centerline of the continental United States).

Five major transportation and utility systems were examined: highway and railroad systems; electrical transmission systems; communication systems; and pipelines. Comments and contributions were solicited from Federal, State, and local government agencies, industry, and public-interest groups such as conservationists, preservationists, and the like. Without exception, their comments and criticisms were constructive and did much to add impetus to the study.

Two types of corridors were studied, each representing an extreme of corridor design: joint-use corridors, and planning corridors. Joint-use corridors are narrow, have fixed boundaries, and may contain more than one transportation or utility system, such as a gas pipeline and electrical transmission lines. Unlike joint-use corridors, planning corridors are more expansive, have flexible boundaries, and are a product of area or regional land-use plans, hence their name. Both types of corridors offer advantages and disadvantages which were weighed in the study.

What the study revealed is that in order to minimize ecological and environmental impacts and the proliferation of rights-of-way on Federal land, and at the same time develop and distribute much-needed new energy sources, a certain degree of flexibility will be needed when planning for corridors. Planning corridors, despite some obvious shortcomings, appear to be the most optimum action to take. In some instances, joint-use rights-of-way may also be appropriate, all factors considered, but depend upon the assessment of specific projects and individual siting circumstances. It was determined that the establishment of a national system of joint-use corridors in advance of specific project proposals is unfeasible.

In short, establishing a national system of transportation and utility planning corridors, as defined in this study, is feasible, desirable, and needed. Yet, as this study revealed, there is insufficient information from which to make an informed and intelligent decision as to how and where such a national system should be implemented. Until further statistical, technological, and environmental data are available from government, industry, and the public sector, corridor

decisionmaking must continue on an ad hoc basis. Whenever an adequate baseline of information has been gathered and analyzed, a national policy can be articulated, and a national system of transportation and utility planning corridors can be established -- a system which will provide the optimum benefits to the public, to industry, and to the country.

ACKNOWLEDGMENT

Throughout this study, the corridor study staff received assistance from a variety of sources: the Bureau of Land Management field offices; other Federal, State, and local governmental agencies; the transportation and utility industries; and conservation and environmental interest groups. All were most helpful in providing the wide variety of information needed for this study.

For many, this assistance represented more than a single effort. Often it involved extensive time and considerable expense. To all the agencies, groups, and individuals who contributed to this report, the study staff extends its sincerest appreciation.

FOREWORD

The authority for this study was granted under Section 28 of the Mineral Leasing Act of 1920 (30 U.S.C. 185) as amended by the Act of November 16, 1973 (Public Law 93-153, 87 Stat. 576). Section 28(s) of the amended law relates to rights-of-way corridors and directs that: "In order to minimize adverse environmental impacts and to prevent the proliferation of separate rights-of-way across Federal lands, the Secretary [of the Interior] shall, in consultation with other Federal and State agencies, review the need for a national system of transportation and utility corridors across Federal lands and submit a report of his findings and recommendations to the Congress and the President by July 1, 1975."

Section 28(b)(1) of Title I, P.L. 93-153 further stipulates, ". . . For the purposes of this section, 'Federal lands' means all lands owned by the United States except lands in the National Park System, lands held in trust for an Indian or Indian tribe, and lands on the Outer Continental Shelf. . . ."

By Order No. 2960 of January 23, 1974, the Secretary of the Interior delegated to the Director, Bureau of Land Management (BLM), the responsibility and authority for compliance with the congressional mandate. A Utility Corridor Study Staff was established within BLM's Division of Lands and Realty. This staff was charged with conducting a study to determine the need for a national system of transportation and utility corridors across Federal lands, and with reporting its findings and recommendations.

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I. INTRODUCTION

A. Objective

The objective of this study was to determine if there is a need for a national system of transportation and utility corridors across Federal land and, if so, the feasibility of developing such a system and when.

B. Scope of the Study

Although the study team was charged with the responsibility for studying corridors across Federal lands only, it became evident that to assess the total impacts of such corridors, those non-Federal lands intermingled with and surrounded by Federal lands must also be addressed. Hence, this study has attempted to consider the corridor impacts on the whole, rather than fragmented geographic sections.

Major emphasis was concentrated on the United States west of the 100th Meridian (the approximate centerline of the continental U.S.) and Alaska. West of the 100th Meridian, the United States, exclusive of Alaska, consists of about 47 percent Federal lands. East of the 100th Meridian, less than 10 percent are Federal lands of which the majority are national forest lands. In addition, they are widely scattered and often intermingled with State, county, and privately owned land. Table I-1 lists the federally owned lands within each State; the general land status of the conterminous 48 States is portrayed on Map #1.

Approximately 97 percent of the land area in Alaska is currently federally owned. However, when the requirements of Public Law 92-203, the Alaska Native Claims Settlement Act (ANCSA), are satisfied and land selections due to the State under the terms of its Statehood Act are completed, Federal ownership will be significantly reduced. The approximately two percent of the acreage currently in Alaskan national parks and monuments is not considered by this study. This percentage will increase markedly if legislative proposals creating additional parks, submitted by the Secretary of the Interior to the Congress, are enacted.

The Secretary's current legislative proposals recommend an 83-million-acre expansion of the national park, forest, wildlife refuge, and wild and scenic rivers systems, under provisions of ANCSA. These proposals are portrayed on the general land status map of Alaska, Map #2.

TABLE 1-1

FEDERALLY OWNED LAND - BY STATE
(AS OF JUNE 30, 1974)

STATE	ACREAGE OWNED BY THE FEDERAL GOVERNMENT	ACREAGE OF STATE	PERCENT OWNED BY THE FEDERAL GOVERNMENT
ALABAMA	1,109,368	32,678,400	3.4
* ALASKA	353,383,374	365,481,600	96.7
* ARIZONA	31,934,019	72,688,000	43.9
ARKANSAS	3,178,899	33,599,360	9.5
* CALIFORNIA	45,072,080	100,206,720	45.0
* COLORADO	23,939,395	66,485,760	36.0
CONNECTICUT	9,350	3,135,360	.3
DELAWARE	38,594	1,265,920	3.0
D.C.	10,210	39,040	26.2
FLORIDA	3,425,839	34,721,280	9.9
GEORGIA	2,205,542	37,295,360	5.9
HAWAII	417,015	4,105,600	10.2
* IDAHO	33,732,635	52,933,120	63.7
ILLINOIS	558,401	35,795,200	1.6
INDIANA	475,766	23,158,400	2.1
IOWA	224,150	35,860,480	.6
KANSAS	700,433	52,510,720	1.3
KENTUCKY	1,313,063	25,512,320	5.1
LOUISIANA	1,053,878	28,867,840	3.7
MAINE	130,642	19,847,680	.7
MARYLAND	198,736	6,319,360	3.1
MASSACHUSETTS	79,067	5,034,880	1.6
MICHIGAN	3,392,082	36,492,160	9.3
MINNESOTA	3,354,221	51,205,760	6.6
MISSISSIPPI	1,576,686	30,222,720	5.2
MISSOURI	2,058,902	44,248,320	4.7
* MONTANA	27,648,566	93,271,040	29.6
NEBRASKA	691,378	49,031,680	1.4
* NEVADA	60,832,171	70,264,320	86.6
NEW HAMPSHIRE	710,089	5,768,960	12.3
NEW JERSEY	130,204	4,813,440	2.7
* NEW MEXICO	25,867,262	77,766,400	33.3
NEW YORK	228,899	30,680,960	.7
NORTH CAROLINA	1,945,374	31,402,880	6.2
NORTH DAKOTA	2,295,131	44,452,480	5.2
OHIO	326,710	26,222,080	1.2
OKLAHOMA	1,513,371	44,087,680	3.4
* OREGON	32,223,014	61,598,720	52.3
PENNSYLVANIA	650,449	28,804,480	2.2
RHODE ISLAND	7,851	677,120	1.2
SOUTH CAROLINA	1,141,579	19,374,080	5.9
SOUTH DAKOTA	3,284,386	48,881,920	6.7
TENNESSEE	1,773,410	26,727,680	6.6
TEXAS	3,173,807	168,217,600	1.9
* UTAH	34,865,660	52,696,960	66.2
VERMONT	269,368	5,936,640	4.5
VIRGINIA	2,343,290	25,496,320	9.2
* WASHINGTON	12,575,626	42,693,760	29.4
WEST VIRGINIA	1,054,524	15,410,560	6.8
WISCONSIN	1,807,044	35,011,200	5.2
* WYOMING	30,067,664	62,343,040	48.2
SEE TOTAL			
* U. S. STATES	712,141,466	1,313,429,440	62.6
TOTAL U.S.	760,999,173	2,271,393,360	31.5

SOURCE: Public Land Statistics, 1974, Bureau of Land
Management, Department of the Interior

Unless otherwise noted, the remainder of this report includes Alaska in any reference to lands within the Western United States.

It warrants noting that Alaska attained significance for this study because there, for the first time, Federal and State agencies have begun to formally coordinate efforts in land-use planning and development. Alaska's efforts are a prototype of the coordinated planning that should be conducted if many of our national goals are to be realized.

As a basis for conducting this study, the future right-of-way demands in the Western States and Alaska were projected through 1985. A 10-year planning horizon was considered the maximum for which future right-of-way demands could be projected with any reasonable degree of accuracy. This planning horizon was chosen based upon a consensus of other Federal Agency (regulatory and administrative) and industry representatives.

C. Contributors to the Study

Early in the study, a number of contacts were made to discuss the study requirements and objectives. Officials of other Federal Agencies (both regulatory and administrative) involved with Federal lands, the Governors of those States having significant acreages of Federal lands, and representatives of the highway, railroad, electric transmission, communication, and pipeline industries were consulted. In addition, the services of technical consultants were obtained. An organization chart for the study is given in Appendix B.

As a result of earlier meetings, an interagency coordination group was established to provide data sources and to review the study report draft. Also, a group of transportation and utility industry representatives was established to coordinate and provide data for consideration. They submitted technical data for incorporation into the study and provided assistance to the study team. These industry contacts were sources of expertise who provided pertinent and representative data relating to the respective right-of-way systems being analyzed.

Bureau of Land Management field office personnel provided data relative to the five major transportation and utility systems under consideration. Their inputs consisted of data and information held by BLM State and field offices. Other data furnished were based upon contacts with other Federal Agencies and with State and county governments.

An outline of the study was widely disseminated to other Federal Agencies, preservation and conservation groups, and other Interior Department Agencies. This was done to inform interested groups and to solicit input concerning the proposed study approach. Briefings were given to Washington area offices such as the Citizen's Advisory Council for Environmental Quality, and the Natural Resources Council of America. In this way, interested parties were apprised of the study, its purpose and tentative contents, and their contributions and concerns were solicited early enough to be considered by the study team.

D. Selection of Systems

A large number of transportation and utility rights-of-way exist across Federal lands within the Western United States. Many of these were not deemed relevant to this study because of their extremely short length and only local significance; they include such facilities as the gathering lines from wellheads to storage tanks in oil and gas fields and low-voltage (less than 115 kilovolt) power distribution and transmission lines. It would have been impossible to assess all such rights-of-way within the time allotted for this study.

Five right-of-way systems were identified as being the major transportation and utility systems within the United States and were selected for study. These five systems are:

- electric power transmission lines
- pipelines
- communication lines
- highways
- railroads

The minimum systems sizes considered to be pertinent for this study were:

1. Electric transmission lines of 115 kilovolts (KV) or higher for existing systems, and 230 KV or higher for projected future demands;
2. Natural gas transmission pipelines, coal slurry, and liquid petroleum trunk pipelines, usually 16 inches in diameter or larger for existing lines, and 24 inches or larger for projected future demands. Some smaller-size existing lines were included because of their interstate significance;
3. Non-microwave communication lines of 100 miles or longer;

4. Interstate and primary Federal highways; and
5. Railroads of 100 miles or longer for existing lines and 10 miles or longer for projected future lines.

E. Selection of Corridors

For the purpose of locating rights-of-way, this study examined two extremes of corridor concepts: the joint-use corridor and the planning corridor. A joint-use corridor is a narrow, restricted, heavily-utilized, linear area within which the rights-of-way of several transportation and/or utility systems may overlap or adjoin. Conversely, planning corridors are broad, linear land areas with fairly flexible boundaries. Such corridors are based upon coordinated land-use planning, hence their name. The actual locations of specific rights-of-way within a planning corridor would be determined during and following the planning corridor development based upon detailed analysis of proposed projects. Project sitings within planning corridors may or may not involve joint use of rights-of-way; project data assessment would determine when separate rights-of-way are more desirable. Relocating existing systems into future corridors was not envisioned as a viable action.

II. SUMMARY OF FINDINGS

A. General Findings

The study determined that a national system of planning corridors developed in accordance with area-wide or regional land-use plans that are coordinated among Federal, State, and local governmental agencies, private industry, and the public is both feasible and desirable. There is a need for such planning corridors on Federal lands to minimize the environmental impacts of transportation and utility systems and to avoid proliferation of separate rights-of-way -- proliferation meaning an excessive, rapid spread.

The study further determined that the establishment of a national system of joint-use corridors in advance of specific project proposals is infeasible. However, it may prove feasible to place portions of right-of-way systems in close proximity to each other once project design and site conditions are known.

And, of equal importance, the study revealed that the potential growth of electric transmission and pipeline systems in the Western States will dictate the greatest future demands for rights-of-way across Federal lands. Unless planned in a coordinated manner, these new pipelines and electric transmission lines have the potential for causing adverse environmental impacts and proliferation of rights-of-way.

B. Specific Findings

1. Uncoordinated locations of future rights-of-way across Federal lands could result in the loss of natural resources within or adjacent to the rights-of-way and excessive or unnecessary environmental degradation.
2. A significant increase is expected in the next ten years for electric transmission line and pipeline systems only. The greatest impacts of these systems on Federal lands will be with States west of the 100th Meridian.
3. If systematic and coordinated planning is not implemented, significant proliferation of pipeline and electric transmission line rights-of-way could result across Federal lands in the Western United States because of the development of energy resources.
4. Except for short connections between energy resource areas and existing systems, there is no substantial increase foreseen through 1985 for primary highway or railroad construction across Federal land in States other than Alaska. There is no significant increase foreseen through 1985 for construction of underground communication and electric transmission lines across Federal lands.

5. Each right-of-way system has specific minimum requirements for construction and operating space.
6. Joint use of rights-of-way is often both feasible and desirable. However, this determination depends on specific project evaluation -- each project and its requirements must be analyzed individually.
7. Electric transmission lines cause the greatest interference problems between systems in joint use of rights-of-way.
8. Joint use generally results in a compromise location for rights-of-way, particularly when there is variation in origin and destination of systems. In some instances joint use may not result in the environmentally optimum location.
9. Establishing specific joint-use right-of-way areas across Federal lands could determine the location of rights-of-way across non-Federal lands with a resulting influence on individual property values. Planning corridors would provide the flexibility of alternate routes, thereby minimizing such effects.
10. Planning corridors would not negate the need for case-by-case project analyses. Due to land management complexities and system interrelationships, land management agencies must retain the flexibility to assess all alternative locations, both within and outside of planning corridors.
11. Land-use planning in coordination with future transportation and utility planning is prerequisite to establishing planning corridors. Land-use planning at local, State, and regional levels lacks coordination and uniformity as related to right-of-way locations. Consistent land-use planning is necessary to provide uniform considerations for rights-of-way siting and management, especially in the preliminary and basic planning stages.
12. The amount of Federal land available for future right-of-way needs is diminishing with the continuing designation of special management areas. Future linear right-of-way needs must be fully considered before any Federal lands are designated as special management areas which would constrain right-of-way use.
13. Planning corridors can be established when an adequate information base (natural resources and their values) exists, future right-of-way needs are known, and both are coordinated among Federal, State and local governmental agencies plus industry.

III. RECOMMENDATIONS

The following recommendations are made based upon a determination of the need for a national system of transportation and utility corridors across Federal lands. These recommendations do not address specific corridor locations.

1. That Federal Agencies be directed to identify and reserve across Federal lands a national system of planning corridors, as defined in this study, which are suitable for and shall remain open to future routing of transportation and utility rights-of-way. Specific rights-of-way location (separate or joint-use) within these corridors must be determined on a project basis.

The establishment of such planning corridors must be predicated on the development of an adequate information base containing data on resources, resource values, and environmental values, along with future transportation and utility development needs within the States west of the 100th Meridian. Development of this information base will require the following actions:

- a. Federal land managing agencies must be authorized and directed to mutually develop, consistent with their resource planning system programs, an areawide or regional resource and environmental information base in cooperation with State and local governmental agencies in the Western States.
- b. Federal land managing agencies must be authorized and directed to mutually develop, consistent with their planning system programs, an areawide or regional evaluation of proposed or projected energy transmittal projects on and across Federal lands in the Western States in cooperation with State agencies, public utilities and private industry interests concerned with energy generation and transmittal.

(This recommendation based on findings 1, 2, 3, 4, 11, 12, and 13.)

2. That during the period in which the information base and evaluation of energy transmittal projects are being developed, for lands in the Western States, Federal land managing agencies be directed to grant individual rights-of-way, only after making a determination of the feasibility and practicality of combining individual rights-of-way into joint use on or across Federal lands. (Based on findings 5, 6, 7, and 8.)

3. That Federal land managing agencies retain flexibility to locate rights-of-way, consistent with Federal, State, and local land-use and land resource plans, which will result in the least total impacts, after full consideration of environmental, socio-economic and product delivery costs. (Based on findings 5, 9, 10, and 12.)

IV. THE NEED FOR CORRIDORS

A. Current Situation

1. Background and Definitions

The Congressional mandate was to determine the need for a national system of transportation and utility corridors across Federal lands. The legislation contains two criteria by which to determine the need: to prevent proliferation of separate rights-of-way, and to minimize adverse environmental impacts.

Because Federal lands are adjacent to and often intermingled with non-Federal lands, seldom would a corridor be located on Federal lands only. Consequently, in order to comply with the mandate and yet remain practical, the study team considered all lands, regardless of ownership, with special emphasis given to Federal lands.

For the purposes of this study, a corridor is defined as a linear strip of land forming a passageway between two points in which transportation or utility rights-of-way are now or may be located.

The study examined two opposite extremes of corridor concept. The first, planning corridors, involves broad linear areas with flexible boundaries. The second, joint-use corridors, involves a narrow linear area with restricted boundaries within which a part or all of any system could be located.

A planning corridor is a broad strip of land of variable width between two geographic points which has ecological, technical, or economic advantages over other adjacent areas for the location of rights-of-way anywhere within its boundaries. It assures opportunities for the location of future rights-of-way. Such corridors are a result of and dependent upon coordinated land-use planning founded upon a data base which includes identification of existing resources, resource values, environmental values, and future transportation and utility needs.

Such an information base must be developed through a cooperative planning effort by Federal Agencies involved with the public lands, State and local entities, private industry, and the general public.

In effect, the planning corridor process identifies the areas which will suffer the least environmental impact from and still be suitable for the location of future rights-of-way. Sufficient flexibility should be provided in any land-use plan so that, if it is later determined to be in the best public interest to locate a system in a route other than within the identified planning corridor, it is possible to do so.

Planning corridors must be of variable widths, two miles generally considered the minimum, depending on the land-use data base.

A joint-use corridor is a narrow strip of land with restricted boundaries in which facilities of the same or different systems are placed adjacent to each other in as close proximity as practical and feasible. Joint-use corridors are considered to be in the general range of 500-feet to 1 mile wide depending on the number and kinds of systems involved. The maximum width would be no more than that necessary for all systems to function with almost no interference between them. However, this width may not necessarily be the most desirable. The study found that optimum spacing between systems is determined by a complex set of interacting variables that must be quantified and analyzed, and trade-offs made before a specific joint-use decision can be reached.

Each specific joint-use situation must be analyzed in relation to the following technical and physical variables.

1. The systems involved, their size, design, and potential for expansion;
2. The physical characteristics of the site, particularly terrain, soil, bodies of water, and land use;
3. The length that the systems parallel;
4. The potential interference between systems;
5. The mitigation practices and their costs to reduce interference problems;
6. System reliability, safe operation, and maintenance; and
7. The resource and environmental values to be affected by the uses within the corridor.

2. Proliferation

Although 70,000 separate grants for rights-of-way were awarded over the years there is no data identifying the kinds and sizes of these rights-of-way (Senate Report 93-207 and Federal Agencies records). Since only summary data were available to the study team, there was no way to relate this data to the five systems under consideration, nor were there any statistical data pertinent to the acreages involved and the rate of spread. Consequently, since it was impossible from the available data to determine any past proliferation trends, the study team felt it would be more fruitful to assess future right-of-way developments and the potential proliferation therefrom.

Published data and projections from industry sources and Federal and State agencies were consulted, resulting in the following observations of each system's potential for expansion on Federal lands (Data sources are listed in Appendix A). These projected developments will not be located totally on Federal lands but will nonetheless have significant impacts on them.

Electric Transmission (See Map #5 for the existing and projected system.)

- ° Western Systems Coordinating Council projects that 20,500 circuit miles of new electric transmission lines will be needed by 1984 in the Western States. (Total electric demand growth rate just under 7 percent per year.)
- ° Even with full conservation measures, Federal Energy Administration's projections indicate significant growth in electric transmission. (Total demand growth rate 4 percent per year.)
- ° Federal lands will be involved, especially for right-of-way needs associated with new coal-fired generating plants.

Pipelines (See Map #6 for the existing and projected system.)

- ° Some 11,400 miles of pipelines involving Federal lands are under study, proposed, or have right-of-way applications on file with agencies.
- ° Development of Rocky Mountain oil, natural gas, and coal resources will require pipelines for all products to link resource areas with existing pipeline systems.

Communications (See Map #7 for the existing and projected system.)

- ° Two new coaxial cables - St. Louis to Los Angeles and Los Angeles to San Francisco - will essentially complete existing buried facilities affecting Federal lands.
- ° Future needs will be met by expanding the capacity of existing systems including coaxial cable, microwave, and satellite technologies. The buried waveguide system being tested is not expected to affect Federal lands. (Communications industry sources.)

Highways (See Map #8 for the existing system.)

- ° The Interstate Highway System in the conterminous 48 States is 84 percent complete with an additional 15 percent under construction or in the planning stages. Significant expansion is not expected.
- ° Primary highways will be improved by widening and minor relocations.
- ° New highways will be needed to link resource development areas with existing network.

Railroads (See Map #9 for the existing system.)

- ° Total miles of mainline track is declining.
- ° No significant demands for new rights-of-way are seen in the conterminous 48 States except for linking resource areas with existing systems where railroads will be the selected mode for transportation.

Electric transmission and pipeline systems are the only ones with appreciable right-of-way growth anticipated through 1985. It is expected that there will be an increased need in the near future for rights-of-way across Federal lands for these two systems because of increasing per capita consumption of energy and the President's Project Independence Program to make the United States energy self-sufficient within the 1980's. This will require linking of developing coal, oil, and gas fields (and possibly oil shale) with the market areas. Such linkage will be either through physical

movement of energy resources for power generation and petroleum refining, or from on-site energy development followed by transportation to markets. The extent and timing of such development cannot be accurately predicted at this time.

Such energy resource development is further emphasized by President Ford's January 17, 1975, energy program statement that ". . . within the next 10 years, my program envisions:

- 200 major nuclear power plants;
- 250 major new coal mines;
- 150 major coal-fired power plants;
- 30 major new oil refineries;
- 20 major new synthetic fuel plants; and
- the drilling of many thousands of new oil wells."

Most assuredly, such future developments are expected to impact Federal lands by requiring plant sites and related rights-of-way for electric transmission lines and pipelines. Known fossil fuel and geothermal resource area locations where this development may occur are shown on the organic fuel deposit Maps, #3 and #4.

Energy conversion facilities such as coal gasification plants; nuclear, geothermal, and fossil fuel power generating plants; and oil shale plants will require rights-of-way to transport the primary commodity. Remote sites will also require service rights-of-way to bring in water, build access roads, and provide electricity and communications. Although most site locations for rights-of-way cannot be precisely identified at this time, significant rights-of-way associated with energy conversion plants can be anticipated.

Current energy resource development proposals stop short of specifically selecting or recommending transportation modes and market or end-use locations. Consequently, future needs for rights-of-way must be expressed in general terms, without advocating any particular developmental thrust.

The individual system maps for electric transmission lines and pipelines indicate the general location of proposed lines. The importance of Alaskan oil and gas discoveries is indicated by a trans-Canada natural gas pipeline project proposal. Several of the pipelines involved are shown on Map #6. For Federal lands, crude oil pipelines being discussed at this time are from the West Coast to Midland, Texas, and Midwest refineries, once Alaskan crude is delivered to the West Coast by tanker.

Reports such as the Northern Great Plains Study, 1974, by the Department of Interior and the Project Independence Report, 1974, by the Federal Energy Administration, estimate quantities of energy resource to be transported from organic fuel deposit areas in the next 10 years. However, these estimates have been based on a multitude of variable factors which depend on priorities or emphases of Federal policies. For example, the FEA's Project Independence Report indicates that about 17 percent of America's coal flows out of Western coal fields in the Northern Great Plains, Rocky Mountains, and the Pacific Coast, where the majority of the Federal lands are located. The report states that demand levels for the next 10 years are not projected to bring about massive development of the Western coal fields. However, if the demand for low-sulphur-content coal is increased significantly, the flow of coal from Western coal fields could increase accordingly. Again, this increase would depend on Federal and State policies and priorities. This report does not attempt to analyze the quantities estimated in such energy reports, but it does recognize the potential for such energy resource development and attendant impact upon Federal lands without attempting to predict when, where, and to what extent such development may occur.

Although data reviewed in this study have not indicated a general tendency toward right-of-way proliferation, in the sense of "excessive, rapid growth" across Federal lands it can be anticipated that extensive development of the natural resources in the Western States could result in a proliferation of rights-of-way if land-use is not properly planned.

3. Environmental Impacts

The second criterion specified by Congress in reviewing the "need" for a national system of transportation and utility corridors across Federal lands involved minimizing adverse environmental impacts resulting from right-of-way development. The National Environmental Policy Act of 1969 (NEPA) requires an assessment of environmental, social, and economic impacts resulting from any major Federal actions having a significant environmental impact. The NEPA requirements open the decisionmaking process to public scrutiny and provide opportunities for judicial determination of compliance with the law. Environmental impact statements are drafted by Federal Agencies to assess the impacts of projects and the alternatives for consideration in the decisionmaking process. A draft is circulated to other agencies and the public for comment. The comments received and those adopted appear in the final environmental impact statement, which accompanies the proposed action through the decisionmaking process.

The NEPA process requires environmental inventories or baseline studies including detailed information regarding the proposed action. For rights-of-way, this involves a detailed description of the project including size, design, construction techniques and timing, and mitigation and safety practices. Viable alternatives to the project and alternative locations must also be identified and their impacts described. Under current practices, opportunities for paralleling other systems may be explored but such explorations are not mandatory.

It is questionable whether sufficient detailed information would be available to draft a single, adequate environmental impact statement for all future systems that may be located in a planning corridor or joint-use right-of-way. A decision would have to be reached on each proposed project to determine if joint use or a separate route would minimize impacts after sufficient information on the project is available. However, the resource data base used in identifying a planning corridor could be used in preparing environmental impact statements for specific project proposals, resulting in savings of time and money and less duplication of effort.

Individual rights-of-way have varying impacts upon the land they cross. For example, rights-of-way for buried systems such as pipelines, communication lines, and electric transmission lines, temporarily disturb the land and disrupt its use. But, after a period of time, depending upon soil and climate, the land may return almost to its original condition or usage.

Conversely, highway and railway system rights-of-way permanently disrupt land use, for they must command complete land control throughout the life of their service, negating any possible return to prior usage.

The major impacts of linear rights-of-way, either separate or joint-use can best be discussed in terms of surface disturbance, air and water quality, visual and audible effects, and social and cultural impacts, and it is in these terms that they are discussed in this study.

The following discussion is not intended to be a complete analysis of adverse impacts. It does recognize, however, that there can be a direct conflict between the development of rights-of-way and the management of wildlands and open spaces. And, from that context, its purpose is to illustrate the major environmental concerns and values associated with the development of rights-of-way.

a. Surface Disturbance

Construction activity for all systems involves various degrees of right-of-way clearing, soil disturbance, and displacement. Pipelines and buried communication cables require a cleared and rough-leveled construction area wide enough for equipment and vehicles to operate. They do not require large cut-and-fill sections except in side hill situations. Highways and railroads may clear and disturb the entire right-of-way and in addition have wider areas for cut-and-fill sections. Electric transmission lines necessitate clearing trees that will interfere from the right-of-way, but low-growing vegetation remains. Tower sites and access roads are cleared of vegetation and a working area is leveled. The degree of erosion, nutrient loss, and downstream siltation experienced depends on the amount of area cleared, soil type, terrain, rainfall characteristics, and the erosion control measures practiced. Many times these disturbances can be temporary if the sites have good soil and climatic conditions, and the disturbed areas are reseeded.

In addition to altering the land, right-of-way construction also may affect the wildlife, aquatic life, and marine biota in the area of the construction site. For example, right-of-way fencing, common to railroads and highways, can interrupt migration and drift patterns of some wildlife species and domestic animals. And, conversely, the access and service roads associated with rights-of-way provide access to wildlife areas heretofore unavailable to vehicles, disturbing habits and breeding patterns of some species of game. In addition, construction may alter the native vegetation, perhaps to the benefit of some species, but to the detriment of others.

These factors must all be considered when planning the kinds of rights-of-way to be developed and where they are to be placed.

b. Air and Water Quality

Lakes, rivers, and streams, too, are affected by construction. Some sedimentation and erosion is unavoidable when large amounts of earth are being moved, which can be critical if spawning beds are being fouled; aquatic life may be affected, as well as potable water supplies.

Dust from construction equipment and emissions from construction vehicles temporarily degrade air quality adjacent to construction sites. The air is fouled and the dust coats anything in the near vicinity. In addition, the dust pall raised is physically and aesthetically unpleasant.

c. Visual and Audible Impacts

Due to their linear nature, right-of-way construction activities and the unavoidable scars left on the land are highly visible. Swaths cut through timber and the abrupt conversion of heavy shrub cover to grass and forbs can be visible for miles. When this change occurs in an area where examples of man's activity have not been evident, it often adds a discordant line that attracts attention. The impact of such lines on the landscape varies with the terrain, vegetative cover, and the presence or absence of linear patterns such as roads, fences, farm fields, and other rights-of-way.

Aboveground structures also increase visual impact. Transmission line towers can be aesthetically designed, but remain highly visible and obtrusive when placed in otherwise unspoiled settings.

Construction equipment noise and blasting noise can have a severe but short-lived impact on wildlife and the human values associated with solitude. Traffic and pumping station noises are less severe following construction but will continue for the life of the project.

d. Cultural Considerations

Without some sort of protection, archaeological, historical, or religious sites may be altered and destroyed by right-of-way and related construction activity. If vehicle access was not available before construction of the right-of-way, this access may lead to vandalism of such sites.

Impacts in the major categories of environmental concerns -- surface disturbance, air and water quality, visual and audible impacts, and cultural considerations -- can and are being reduced through legal and regulatory requirements and voluntary measures. For example, controls on construction practices and timing, plus revegetation efforts reduce erosion and wildlife disturbance; stipulations are used in right-of-way grants to require compliance with air and water quality standards and laws protecting historic and archaeological sites; and frequently, right-of-way applicants fund research and other special studies to determine the extent of adverse impacts on certain species and what mitigating measures can be devised. These measures are important, but they would be applied equally in a corridor or in separate right-of-way situations. Even with existing regulatory and voluntary controls, problems remain concerning both the number of and locations for rights-of-way.

e. Environmental Impact Comparison-- Joint-Use
vs. Separate Rights-of-Way

To accurately compare the environmental impacts of joint-use vs. separate rights-of-way, one would have to have an extensive information base, including total resource identification and its value, environmental values, and social values. The data reviewed for this study indicated that such a data base presently does not exist for all lands within the study scope. Therefore, the following comparison examples will only indicate the possible savings in surface disturbance and land area commitment which may be anticipated from joint use. (Technical problems of joint use are discussed in the feasibility section.) In these examples, pipelines and electric transmission lines are anticipated to be the only systems having a significant need for future rights-of-way across Federal lands.

° Pipeline Parallel to Existing Pipeline

The spacing shown in Figure IV-1 indicates a 57 percent savings in new surface disturbance for a 48-inch pipeline if it is built adjacent to another pipeline in normal soil. This represents 10.4 fewer acres per mile for the situation shown compared to a separate pipeline route. Additional reduction in surface disturbance may result by the second pipeline sharing the access road, electrical power, and communication facilities of the original pipeline.

° Pipeline - Railroad Parallel

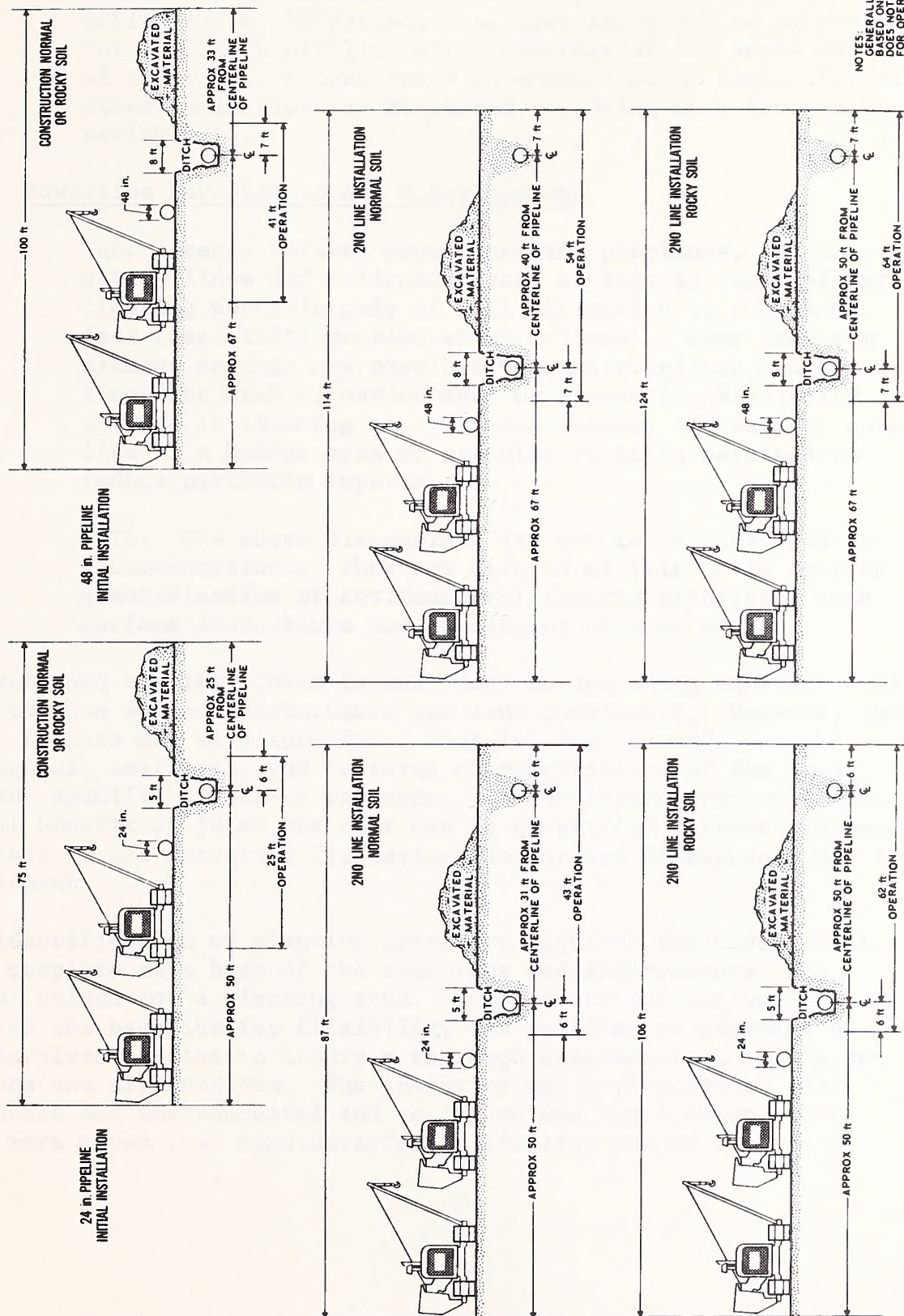
A 50-foot overlap into an area cleared for a 200-foot railroad right-of-way (leaving a 50-foot buffer area to the edge of the track for safety) results in 50 percent less clearing for a 48-inch pipeline and a savings of 6 acres per mile of parallel use. Savings may also result by sharing the railroad access roads and the communication facilities.

° Pipeline - Highway Parallel

With a 30-foot overlap into the area cleared for a highway right-of-way (leaving a 50-foot buffer area between the pipeline and the edge of the shoulder of the highway for safety), 30 percent less clearing is needed for a 48-inch pipeline and there is a 3.6-acre saving per mile of parallel. Separate access would be needed along the pipeline between interchanges on controlled-access highways, thus no access savings.

FIGURE IV-1

PIPELINES - SINGLE-USE RIGHTS-OF-WAY (Typical Installations)



NOTES:
GENERALLY, ROW WIDTH ACQUIRED IS
BASED ON CONSTRUCTION NEEDS -
BASES NOT NECESSARY TO WIDTH NEEDED
FOR OPERATION

SOURCE: The Aerospace Corporation, 1975

° Pipeline - Buried Communication Cable Parallel

With a 40-foot cleared right-of-way on one side of a communication cable, 40 percent less clearing would be needed for a 48-inch pipeline with a savings of 4.8 acres per mile of parallel. Access roads to communication repeaters and other facilities may be shared resulting in a further land savings.

° Powerline Parallel to All Other Systems

Interference between powerlines and pipelines, communication lines and railroads makes savings in right-of-way clearing possible only if full mitigation is provided (see feasibility section which follows). Some land commitment savings are possible between pipelines and powerlines but each situation must be assessed individually. No savings in clearing are realized between highway and powerline if a buffer area of standing trees is retained to reduce aesthetic impacts.

NOTE: The above discussions are not to be construed as recommendations. They are offered at this point only as quantification of environmental impacts associated with surface disturbance and commitment of land area.

As mentioned earlier, there is much more to comparing environmental impacts than surface disturbance and land commitment. However, the other factors are site specific. That is, they depend upon the ecological, aesthetic, and cultural characteristics of the area and the specific rights-of-way uses. In conclusion, the only environmental benefit of joint use that can be quantified without site-specific data is the potential for savings in surface disturbance and land commitment.

The identification of planning corridors requires the development of a complete data base of the resources and environmental and social values for a planning area. Such identification would provide the baseline for flexibility and coordinated planning by all involved parties to assure a thorough assessment of the interactions and alternatives. The inventory and evaluation of all resources and environmental and social values would assure that they were given full consideration in locating future routes.

4. Findings:

- ° Future development of energy resources could result in proliferation unless coordinated planning for rights-of-way is implemented.
- ° A significant number of rights-of-way across Federal lands will be needed in the next 10 years for electric transmission lines and pipelines.
- ° No substantial increase in primary highway, railroad, or communication line rights-of-way is anticipated through 1985 across Federal lands except in Alaska.
- ° A comparison of individual rights-of-way vs. joint use requires a case-by-case analysis to quantify all of the environmental impacts of each.
- ° In general, pipelines being located in parallel with existing systems, except electric transmission lines, could result in about 30 to 60 percent savings in vegetative clearing requirements, when all routes coincide.
- ° Since rights-of-way involve both Federal and non-Federal lands, impacts on intermingled and adjacent non-Federal lands must be considered.

B. Feasibility of Corridors

1. Planning Corridors

A planning corridor by definition is wide enough to permit alternate routing of rights-of-way, including separate rights-of-way, within its boundaries. Therefore, the feasibility of establishing planning corridors does not depend on compatibility between right-of-way systems or similar physical and technical factors generally associated with joint use of rights-of-way. Important, however, are the engineering and cost factors relevant to the establishment of planning corridors. The area within a planning corridor should, to the extent possible, satisfy the requirements of: (1) minimizing environmental impacts; and (2) being suitable for location of linear rights-of-way. These two objectives are not always harmonious. Therefore, engineering and cost considerations can suffer in the compromise between the two, especially when the project termini lie outside the planning corridor and additional mileage is required.

As mentioned previously, the key to insuring the engineering and economic feasibility of planning corridors is maintaining the flexibility to adjust the corridor boundaries to accommodate new project proposals and even to allow routing outside the corridor when warranted. If the planning corridor is identified, established, and managed as suggested by this study, it will be feasible from an engineering and economic efficiency standpoint.

The main questions concerning the feasibility of establishing planning corridors are: (1) Do the Federal land managing Agencies have the authority to establish and reserve planning corridors? (2) Are adequate planning data available? (3) Who should be involved in the establishment of such corridors?

a. Authority

The basic power and authority over the public domain lands of the United States are derived from Article IV, Section 3, Clause 2 of the United States Constitution. The Congress granted this authority to the Secretary of the Interior by the Act of April 25, 1812, 2 Stat. 716 (R.S. 453, 43 U.S.C. 2), and Reorganization Plan No. 3 of 1946 (60 Stat. 1100). The Picket Act of June 25, 1910, as amended (43 U.S.C. 141, 142), and Executive Order 10355 of May 26, 1952 (17 F.R. 4831) delegated to the Secretary of the Interior full authority to withdraw or reserve ". . . lands of the public domain and other lands

owned or controlled by the United States in the continental United States or Alaska" Section 2 of this Executive Order authorized the Secretary to ". . . issue such rules and regulations and to prescribe such procedures. . ." as are necessary for the exercise of this withdrawal and reservation authority. Pursuant to this authority, the Secretary may withdraw or reserve lands for any public purpose, including utility or other right-of-way corridors.

On acquired Forest Service lands, no specific withdrawal authority is required. However, the Forest Service cannot authorize uses which interfere with any valid existing rights, such as easements and mineral rights. These existing rights could be a factor to be reckoned with when establishing specific planning corridors. However, the constitutional authority, as cited above, does exist by which planning corridors can be implemented.

b. Availability of Data Base

Total resource, environmental, and land use data -- the data needed for planning corridors -- are unavailable at this time for the Western States. Such a data base has been established in a prototype for Alaska by a Joint Federal-State Land Use Planning Commission. It is used for delineating tentative corridors relative to the requirements of the Alaska Native Claims Settlement Act for reservation of public easements and requirements of Public Law 93-153 which amended the Mineral Leasing Act of 1920. A data base for the Western States should include all land -- Federal, State, and private -- if planning corridors are to be delineated successfully. In addition to projected transportation and utility system needs, it should contain at least the following basic information categories:

Climate	Biotic Communities
Topography	Human Population
Geology and Minerals	Economics
Water	Land Status
Soils	Existing Land Use
Scenic and	Historic and Cultural Resources
Recreational Resources	Resource Development

Much of the resource and land-use data exist in various forms and depth, but they must be reviewed, supplemented, updated, and compiled. But, even with proper coordination and adequate funding, it will take time to acquire and develop the information base. How much time is indicated by legislative proposals and Federal Agency estimates. For example, recent legislative proposals indicate a range of 5 to 8 years will be required for grant programs to the States for land-use planning. According to Bureau of Land Management estimates, it would take at least 5 years to complete effectively an existing natural resource planning base on the 474 million acres under its administration.

c. Coordination

As has been emphasized, the successful establishment of planning corridors would require a coordinated effort involving Federal, State, and local governments; public and private utilities; and the public. Unfortunately, there is no existing mechanism, such as a national land resource management act, to initiate this coordination. As of March 1975, four of the Western States had enacted land-use legislation and seven had enacted utility-siting acts (Source: State Government Offices). But, for the most part, these are recent laws, and the coordination necessary remains to be fully realized. Some counties, too, have developed land-use plans, but according to Bureau of Land Management field office personnel, none have addressed right-of-way needs directly.

Moreover, it is impossible to establish a feasible system of planning corridors without a deep involvement by the industries concerned, particularly the electric and pipeline companies with their predicted heavy demands in the future. Their professional assistance must be utilized simultaneously with the data base in evaluating suitable areas for the location of rights-of-way.

And, because planning corridors would encompass lands of non-Federal ownership, and nearly all would abut non-Federal land, public input would also be needed to effectively establish acceptable planning corridors.

2. Joint Use of Rights-of-Way

During this study, many cases of joint use of rights-of-way were examined. Although some problems have occurred, most systems in joint use are operating satisfactorily. The important point, however, is that the systems were placed in joint use only after: (1) an individual determination of need for joint use, and (2) an evaluation of systems compatibility based on specific project data. These two considerations - need and compatibility - will remain primary factors in future joint-use decisions.

This study cannot report categorically on the feasibility of joint use of rights-of-way. Research revealed that the question of feasibility must be addressed on an individual case-by-case basis and depends on engineering factors influencing the location of each system, the technical compatibility of the systems in parallel, the cost considerations relating to joint use, and the effect of joint use on systems reliability. These factors are discussed in the paragraphs which follow.

a. Engineering Considerations

A major consideration in evaluating the feasibility of joint use is a comparison of the engineering criteria controlling the location of the various systems. It was found that joint use of rights-of-way is usually a compromise not representing the optimum location for all joint users. This does not in itself make joint use infeasible. However, conflicts among engineering criteria can increase to a level where parallel locations become no longer feasible or practical from an engineering standpoint.

The basic engineering requirements for the location of each system are:

(1) Electric Transmission Lines

The ideal route for electric transmission lines is a straight line: it saves materials, reduces construction costs, and minimizes electrical power losses. However, since the ideal is rarely encountered, transmission lines are often built through mountainous terrain, across gorges and rivers, and other less-than-ideal conditions. To do this, towers must be located on stable ground and designed to withstand weather extremes which require special and costly design and construction.

(2) Pipelines

Economics dictate using the shortest route practical. Horizontal and vertical alignments are not critical but bends and slope increase pumping costs. The right-of-way must be cleared, with a construction area graded for the entire length. For obvious reasons, rocky soils are avoided where possible, as are steep canyons and rivers, fault zones, and landslide areas.

(3) Communication Lines

The most desirable route is the shortest path. Soils which can be easily trenched are best for underground cable locations. Steep canyons, rivers, fault zones, and landslide areas are avoided where possible.

(4) Highways

Routes for highways are primarily influenced by the location of population centers and the physical features of the terrain and drainage patterns. Highways are restricted by grades and must meet certain vertical and horizontal curvature criteria. Easily excavated high-strength permeable soils are preferred for highway construction.

(5) Railroads

Railroads are extremely grade-sensitive, and their routing is strongly dependent on terrain and associated drainage. Stable soils are preferred to reduce railroad costs. Like highways, railroads require considerable excavation and follow winding paths through rolling or mountainous terrain.

Table IV-1 lists typical right-of-way requirements.

Table IV-2 illustrates the physical incompatibility among some systems due to grade constraints.

TABLE IV-1

RIGHT-OF-WAY WIDTH REQUIREMENTS - BY SYSTEM

System	WIDTH REQUIRED DURING	
	Construction and Major Repairs	Operation
<u>Electric</u> <u>1/</u>		
230 KV	100-150	100-150
345 KV	150-170	150-170
500 KV	135-200	135-200
765 KV	200-225	200-225
400 KV (direct current)	140-150	140-150
<u>Pipeline</u> <u>2/</u>		
1-24" (loamy or rocky soil)	75	25
1-48" (loamy or rocky soil)	100	41
2-24" (loamy soil)	87	43
2-48" (loamy soil)	114	54
2-24" (rocky soil)	106	62
<u>Railroad</u> <u>3/</u>		
2 tracks	100-200	100-200
<u>Highway</u> (4 Lanes)		
Restricted (no expansion of frontage road)	90-110	90-110
Intermediate (no frontage road)	140-180	140-180
Desirable	210-310	210-310
<u>Communication</u> <u>2/</u>		
Overhead open wire	50	16
Buried shielded pair	25-30	16-30
Buried coaxial cable	100	50
Buried wave guide	100	50

- 1/ The ranges shown are for single-circuit lines, but will generally accommodate most double-circuit line designs.
- 2/ Industry practice is normally to retain entire construction right-of-way width on non-Federal lands.
- 3/ Federal Railroad Right-of-Way Act of 1875 set right-of-way width at 200 feet.

SOURCES: The Aerospace Corporation, 1975 and the Electric Industry

TABLE IV-2

MAXIMUM ALLOWABLE GRADE - BY SYSTEM

System	Maximum Allowable Grade
Electric Transmission Line <u>1/</u>	100%
Communication Line	100%
Pipeline -oil and gas <u>2/</u>	---
-coal slurry	13-16%
Highways -design speed, 70 m.p.h.	3%
-design speed, 60 m.p.h.	4%
-design speed, 50 m.p.h.	5-7%
Railroads	1% (desired) 2.2% (rare)

1/ It is seldom that a tower is located on a 100 percent (45°) slope. Conductors have no grade restrictions.

2/ There are no standard maximum grades for oil or gas pipelines. Technically, it is possible to pump vertically.

SOURCES: The Aerospace Corporation, 1975 and Energy Transportation Systems Incorporated, 1974.

As an example of conflicting location criteria, consider a proposal to parallel an existing electric transmission line with a new pipeline. Assume the powerline traverses a mountainside with the towers located on rocky ridges and the conductor spanning draws. This is a reasonable transmission line location, but such a location could cause problems in pipeline construction, such as difficult access, solid rock excavation, drainage interference, and potential landslides. If these problems are severe enough, a parallel location for the pipeline would be ruled infeasible for strictly engineering reasons.

But, the study found that physical conditions are often such that at least some of the systems can sometimes be located parallel and adjacent. In addition to physical constraints joint use entails certain technical compatibility problems, as discussed in the following section.

b. Technical Compatibility

Figure IV-2 shows the interaction between the five systems in joint use of rights-of-way. Although the systems affect each other in varying degrees, high voltage electric transmission lines present the greatest problems for joint right-of-way usage. This is due to electrical phenomena associated with powerlines which, if not mitigated, can adversely affect nearby facilities. Radiation from powerlines can interfere with AM radio and television reception and can produce an audible crackling noise. These effects would be of interest when considering a joint use between a transmission line and a highway where commercial and residential developments or highway rest areas may be involved.

Of more serious consequences are voltages and currents which can be induced into metallic objects close to a transmission line, particularly where long parallels are present. In addition to interference with wire communication and railroad signaling systems, these induced voltages and currents present shock hazards. They can also, in certain conditions, contribute to corrosion of buried pipelines and cable sheaths.

Another problem involves what are called "fault currents." If a transmission line current reaches the ground (for example from a lightning strike), it can flow through the earth and enter a pipeline or buried cable resulting in damage to terminal equipment, ruptured pipelines and shock hazards.

The type and degree of incompatibility depends on such variables as the design characteristics of each system, the separation between systems, the length of parallel, the resistance of the soil to the flow of electricity, and climatic conditions.

The usual means of avoiding potential incompatibilities is to provide adequate separation between the systems. Minimal spacings for acceptable performance would result in a corridor configuration similar to that shown in Figure IV-3. This configuration assumes flat, rural land with suitable soil conditions for all systems.

Figure IV-4 assumes the same systems and conditions, but the systems were rearranged and the corridor width compressed, locating all other systems within the influence of the electric transmission line. Mitigation measures can be employed to reduce the electrical effects to an acceptable level, but the type and amount of mitigation can only be determined through close coordination among technical experts on a specific project basis. In this example, mitigative measures may be required on all systems except the highway, in order for this joint use to be feasible.

FIGURE IV-2

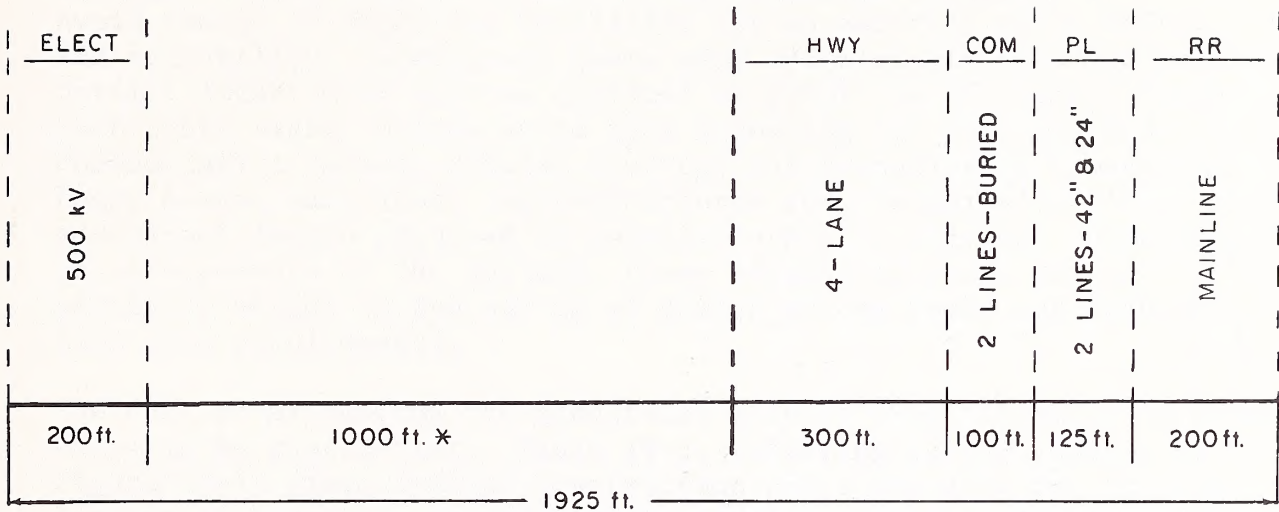
SYSTEMS INTERACTIONS IN JOINT USE OF RIGHTS-OF-WAY

Affected Systems Influencing System	Electrical Transmission	Communications	Pipelines	Railroads	Highways
Electrical Transmission	Reliability degraded. Safety during maintenance from voltage gradient.	Steady state noise. Fault & lightning damage. Shock hazard. Corrosion of cable sheath. Construction damage.	Corrosion. Shock hazard. Fire/explosion hazard. Construction damage.	Shock hazard. False control signals. Fire hazard. Communications interference.	Radio noise. Audible noise. Fire hazard. Shock hazard.
Communications	Faults during construction.	Crosstalk. Cathodic protection interaction. Construction damage.	Cathodic protection interaction. Construction damage.	Construction damage.	Access interference.
Pipelines	Faults during construction. Fire/explosion hazard.	Cathodic protection interaction. Fuel leak damage/personnel safety. Construction damage.	Cathodic protection interaction. Fuel leak/fire and explosion hazard.	Construction damage. Fire/explosion hazard.	Access interference. Fire/explosion safety hazard.
Railroads	Derailment caused outage - reliability degraded.	Electrified RR's same problem as power. Derailment damage to repeater stations or above ground facilities.	Electrified RR's same problem as power. Derailment damage to valves, compressor or pumping stations, etc.	Reliability degraded due to possible accident. Safety degraded.	Safety degraded due to potential accidents. Access interference.
Highways	Reliability degraded due to accident related outages.	Damage to repeater station or above ground facilities due to vehicle accident.	Vehicle damage to above ground facilities due to accident.	Reliability degraded due to possible accident. Safety degraded.	Safety degraded due to potential accidents. Access interference.

SOURCE: The Aerospace Corporation, 1975

FIGURE IV-3

JOINT USE - NO MITIGATION
(10 Mile Parallel)

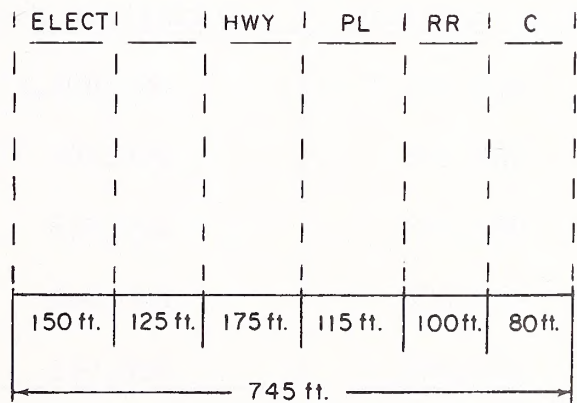


* In order to maintain no mitigation under adverse conditions and long parallels, this distance may be as great as 14,000 ft.

SOURCE: The Aerospace Corporation, 1975

FIGURE IV-4

JOINT USE - CONSIDERABLE
MITIGATION
(10 Mile Parallel)



NOTE: These configurations have been used in this study for comparison purposes only. They have not been proven for applicability.

SOURCE: The Aerospace Corporation, 1975

c. Economic Considerations

Construction costs in joint use of rights-of-way will normally be higher because of the precautionary measures necessary to avoid damage to adjoining facilities and to maintain their safety and reliability. Additional costs will often result from the sub-optimal location of systems confined to joint use of rights-of-way. Such costs might include solid rock trenching for pipeline and communication cables, special footings for transmission towers in boggy areas, additional angle-structures for transmission lines, or additional length required to parallel other facilities. Depending on arrangements of the systems, these additional costs may be partially offset by the saving of shared access roads and reduced land area requirements.

The cost of mitigating the electrical effects from transmission lines can also be substantial. Table IV-3, referring to the example in Figure IV-4, gives typical construction costs per mile for various lengths of parallel, assuming flat, rural land with suitable soil conditions.

TABLE IV-3

CONSTRUCTION COST IN JOINT USE (\$/Mile - 1974 Costs)

		10 Mi. Parallel	50 Mi. Parallel	100 Mi. Parallel
System	Base cost/Mi.	Cost with Mitigation	Cost with Mitigation	Cost with Mitigation
HWY	1,500,000	1,500,000	1,500,000	1,500,000
PL (2)	500,000	500,000	503,000	503,000
RR	600,000	610,000	630,000	630,000
COMM (2)	300,000	305,000	360,000	450,000
ELECT	220,000	230,000	230,000	230,000

NOTE: The systems listed above are of the same size shown in Figure IV-3.

SOURCES: The Aerospace Corporation, 1975 and Industry

d. Reliability

The placement of systems in close parallel tends to degrade service reliability for the systems involved. Examples of joint use related disruptions are:

1. Men and equipment working on one system damaging adjacent facilities;
2. A train derailment or highway accident damaging adjoining systems;
3. Explosion from a gas pipeline rupture damaging adjacent systems; or
4. An accident, sabotage, or natural disaster disrupting all systems in close proximity.

The term "reliability" takes on additional significance in the electric utility industry. Electrical systems must be designed to prevent cascading, widespread outages. The term "cascading" indicates a domino effect of circuit breaker tripping due to overloads or other causes until the transmission system is separated into small functioning islands or is completely de-energized. (The classic example of a cascading, widespread outage is the northeast blackout of November 1965.) If simulation tests indicate that the loss of adjacent transmission lines would result in a cascading outage, the adjacent location is unacceptable unless the system integrity can be enhanced by some other means.

Because of high circuit capacity now provided by our communications network -- up to as many as 230,000 circuits, a mix of service such as military, financial, TV, and general public, and the complexity of connecting arrangements -- any interruption of this service has a tremendous impact. Moreover, a cascading effect similar to that discussed earlier is always a threat: loss of one line may overload the capacity of alternate circuits and equipment, causing further disruption.

Gas pipelines, too, can fail, interrupting service to large consumer areas. If the gas supply is completely cut off to a local distributor, after the problem has been located and corrected, all service lines must be bled and all pilot lights relighted in order to restore service -- a time-consuming and expensive process.

Reliability for highways and railroads is established during the initial system design and maintained through material control, construction criteria, operating procedures, and adequate inspection and maintenance. Service reliability is important to these systems but in a sense is not as critical as for the utilities, where loss

of one line can cause a widespread disruption. However, the transportation systems have rigid requirements for safety, and to the extent that reliability is achieved, a basis for safety is also achieved.

A factor which may influence all or any of the above systems is that construction and maintenance activities of joint-use right-of-way users increase the possibility of accidental damage to neighboring facilities. Adequate spacing between systems and cooperation and communication among users can minimize these risks but may increase costs.

3. Findings

- ° Adequate authority exists for the establishment of planning corridors on Federal lands.
- ° A national system of Planning corridors is feasible. However, the establishment of such a system requires an adequate information base and coordinated land-use planning, neither of which is adequate at this time.
- ° A Federal policy of preestablished joint-use corridors is not feasible. The extent of engineering problems, technical incompatibilities and reliability effects, and the associated design requirements, mitigative measures and costs cannot be determined prior to specific site evaluation.
- ° Joint use is feasible, provided that terrain, drainage, geology, and soils are suitable, and the systems are compatible or can be made so at a cost acceptable to society.
- ° Each right-of-way system has specific minimal requirements for construction space and operating space.
- ° Technical incompatibilities exist between systems operating in close proximity. Electric transmission lines are the major problem source.
- ° Joint-use costs will generally be greater than those of separate rights-of-way because of (1) special construction requirements, (2) suboptimal locations for some systems, and (3) mitigative measures.
- ° The placement of systems in close parallel tends to degrade their reliability.

C. Desirability of Corridors

In the feasibility assessment, it was determined that a Federal policy of nationwide preestablished joint-use corridors is not feasible. However, it was determined that planning corridors and individual determinations of joint-use rights-of-way are feasible.

Therefore, the following discussion treats first the desirability of planning corridors, then the desirability of joint use of rights-of-way.

1. Planning Corridors

a. Land-Use Planning Considerations

The planning corridor concept is predicated upon totally coordinated land-use planning -- the process in which systematic inventories are made to identify environmental and resource values, the conflicts between various uses or development thrusts are identified, and goals or objectives are established for protection of critical values and/or for guidance of development.

In effect, land-use planning seeks that blend of resource protection and development that is deemed socially acceptable and is based on maximum use of comprehensive information. This process charts a course for orderly and timely progress toward the stated objectives with a minimum of environmental and social impacts.

Planning corridors are a logical product of coordinated land-use planning because rights-of-way, by their linear nature, impact lands of different ownerships, resource values, and environmental quality. Land-use decisions affect resource development locations, industrial and utility plant sitings, and community expansions, which in turn directly influence the need and opportunity for utility and transportation rights-of-way.

There are land-use designations and classifications on Federal lands which affect the location of rights-of-way to varying degrees. Wilderness areas by law prohibit rights-of-way unless specifically approved by the President. National and State park systems restrict locating rights-of-way on lands designated as parks because rights-of-way generally conflict with the objectives of park management. Within wildlife refuges, wild and scenic rivers, some coastal zones, military reservations, and some Indian reservations, rights-of-way are obtainable, but only if they are, or can be made, consistent with the purposes for which the area was established.

There are other land areas which possess special values identified in the resource planning systems of the Forest Service and Bureau of Land Management. Management objectives are established for these land areas which may conflict with right-of-way use. Examples are: areas with scenic or open-space value; critical wildlife habitats, including those of rare and endangered species; fragile watersheds; and unique plant communities of scientific interest.

Right-of-way proponents are concerned that protected areas such as described above are increasing and may become barriers to future right-of-way use. Also, establishing such restricted areas may tend to force rights-of-way between or around them regardless of route suitability thereby compounding right-of-way problems. Therefore, all land uses, including linear right-of-way needs, should be fully considered before restrictive land-use decisions are implemented.

b. Environmental Considerations

The primary environmental benefit that planning corridors would achieve is the identification and avoidance of critical environmental areas. Critical wildlife habitats (including rare and endangered species protected by Public Law 93-205) and fragile ecosystems, where surface disturbance would result in erosion and other adverse ecological impacts, could be avoided. Areas of unique scenic beauty, areas of important food and fiber production, and open-space areas free from evidence of man's use can be established and maintained in concert with the identification of planning corridors. Further location of separate rights-of-way would be controlled to the extent warranted by specific conditions within a geographic area through the use of planning corridors. Decisions to locate rights-of-way outside planning corridors would require demonstrating that the planning corridor had been fully considered and that the public interest would be best served by a separate route.

c. Economic Considerations

Because planning corridors are dependent upon land-use planning, a brief discussion of the general costs and benefits of such planning is appropriate. Currently the Bureau of Land Management spends approximately 9 million and the Forest Service approximately 10 million dollars annually on resource and environmental inventories, evaluations, and the establishment of management objectives. Several bills have been introduced in Congress to fund and implement land-use planning. Three current proposals contain authorizations ranging from \$300 to \$800 million over a 5 to 8 year time period. The Department of the Interior in early 1975 estimated that an 8-year national land resource planning effort could be implemented with a grant program of 450 million dollars to the States.

Expenditures at this level would result in many social benefits not related to planning corridors. In particular, duplication of data gathering would be avoided, resulting in lower costs. The valuable data base obtained would be made available for the use of all interests seeking orderly and coordinated future developments, in addition to location of rights-of-way.

The primary economic benefits of planning corridors would come from allowing timely development of energy resources and the flow of products to consumers with a minimum of delay resulting from disputes over the location of rights-of-way. As secondary benefits, the data bank and land-use goals would also accelerate the NEPA process in the identification and assessment of rational alternatives when specific projects are proposed; the route with least environmental impact could be identified from the environmental baseline data gathered. Through coordination, planning corridors take into consideration right-of-way needs and seek to reserve areas from incompatible development or erroneous management decisions. This would provide an economic benefit for right-of-way users and would add a degree of certainty to their internal planning efforts.

This discussion of benefits is not meant to imply that public expenditures on land-use planning would be recovered through direct economic benefits from planning corridors. The greatest benefit would be the systematic gathering and analysis of information and the coordinated use of this information to minimize future environmental impacts and at the same time maximize national progress and development.

d. Social Considerations

The amount of coordinated land-use planning envisioned in the planning corridor concept may not be viewed as socially desirable by many segments of the public, particularly by private land owners in rural areas. It would be exceedingly difficult to implement without being viewed as increasing governmental control over individual property rights. Still, to many of those faced with impending development and change, a coordinated planning approach with full public participation might be preferred over the present separate right-of-way practices.

Planning corridors on Federal lands, as proposed, would offer an opportunity to demonstrate both the land-use planning process and the benefits to be gained from it. It would be a singular opportunity to enlist public cooperation and participation and to demonstrate that actions on Federal land would not inadvertently affect lands of other ownerships. Management and development objectives on all lands would be considered in the routing of future rights-of-way.

e. Coordination Considerations

To be effective, planning corridors must be a product of a coordinated effort among governmental agencies and private industry proposing energy development and ensuing right-of-way use. Office of Management and Budget Circular No. A-95 is a procedure for coordinating Federal and federally assisted programs and projects with each other and with State, regional, and local plans and programs. However, this coordinating mechanism is presently oriented toward completed plans and project proposals. The early planning coordination needed for planning corridors is not operating in all States. The levels of resource and environmental inventories are variable and stipulations or requirements of right-of-way practices vary between Federal Agencies and in some cases within each Agency. The coordination necessary in planning corridor development efforts would identify these conflicts in stipulations and assist in their resolution, while still maintaining policy flexibility to respond to differing environmental and resource management goals.

Resolving coordination problems is particularly difficult when interests conflict, hence controversies over specific projects are common. Planning corridors would offer a mechanism by which decisions to protect certain areas of environmental concern would be reached in a systematic process with the cooperation of government, industry, and the public. Public participation in setting land-use goals can be expected to encourage acceptance and support for the decisions reached.

2. Joint Use of Rights-of-Way

a. Land-Use Considerations

The concentration of facilities in a joint-use corridor leaves surrounding land areas free from right-of-way construction and conflicts and thus available for other uses. Such land-use efficiency is a primary benefit of joint use.

Of the utilities examined, pipelines using portions of established rights-of-way for part of their construction offer the best opportunity to use less land -- particularly pipelines adjacent to other pipelines. However, before placing a pipeline in the proximity of electric transmission lines, the trade-off between separation distances and mitigation costs must be assessed. Communication line

rights-of-way can also be used by pipelines to reduce land commitment. Placing pipelines in the proximity of any other system (except highways) requires that the corrosion protection be coordinated. Highway and railroad rights-of-way, too, can readily be used for part of pipeline construction areas, but only when minimum levels of interference with traffic flow can be assured. Land use efficiency is also improved when two or more systems share a common access road.

Electrical interference problems discussed previously, also limit the opportunities for placing powerlines and other systems close enough to reduce land commitment. These problems are more difficult and expensive to solve if the buried systems are in place before a powerline is proposed. Consequently, preplanning and analysis of the spacing between systems and other mitigation measures are essential if interference levels are to be acceptable. And, particularly with powerlines, the spacing necessary to reduce electrical interference with other systems may obviate significant reductions in land commitment.

Further, the potential for system expansion must be considered in joint-use decisions. Highway and railroad widening, and future building of parallel pipelines and powerlines may limit the opportunities for land savings. Therefore, projections for all systems involved are important considerations in deciding joint-use configurations.

b. Environmental Considerations

Without specific situations, it is difficult to reach generalized conclusions about the environmental impacts of joint use. So much depends on the existing environmental characteristics of the area being considered for joint use and the other alternatives that decisions must be based on the specific project situation.

There are quantifiable reductions in land commitment and surface disturbance attributable to joint use which were described in the preceding paragraphs on land-use considerations. And, it is possible to state that one of the most important benefits from joint use is the avoidance of environmental impacts resulting from constructing another separate right-of-way. The primary justification for concentrating joint-use impacts in the joint-use area is to protect critical environmental areas by routing the systems around them.

However, this would not always be the best action relative to scenic considerations. Joint use tends to concentrate adverse impacts on scenic areas as can be seen in mountain passes and narrow valleys where several facilities have been forced together and dominate the landscape.

c. Economic Considerations

A decision for or against joint use would depend partially on the results of a cost comparison between alternate proposals covering an entire project length. Information required to make this comparison includes: basic design of systems involved, lengths, geology, soil, climate, accessibility, land cover (timber, etc.), land values and acquisition costs, construction costs, and compatibility between systems. Cost estimates are based on specific project data; however, some general observations regarding costs and benefits can be made.

(1) Joint-Use Costs

Increased costs resulting from joint use are in three basic categories:

- Total project costs;
- Construction costs, including mitigation; and
- Relocation costs.

Unless termini and other location determinants for the systems are identical, joint use requires additional length; thus increasing the total cost of the project. Industry cost data (using 1975 prices) for variable terrain, typical of lands in the Western States, indicate a 36" pipeline would cost approximately \$500,000 per mile and a 500 KV electric transmission line would cost about \$300,000 per mile.

Construction activity in close proximity to an existing system requires special methods and precautions to prevent damage to adjacent facilities and hazards to personnel. Costs of mitigating interference problems, too, can be substantial, particularly if an electric transmission system is involved.

In situations where small parcels of private land are involved, joint use by several rights-of-way increases the probability of relocating buildings or other improvements with attendant expenses.

(2) Joint-Use Benefits

The decision for or against joint use should be made only after cost estimates and environmental studies are completed because the decision often involves economic considerations vs. environmental and social impacts. It bears noting that the joint-use option will not always be the most costly, nor will it always be preferable from an environmental standpoint. Situations will arise where an economically desirable parallel location must be discarded in favor of more costly, but environmentally superior, separate rights-of-way.

Once the joint-use decision is made, however, there are some additional benefits to be gained in that the sharing of access roads may reduce costs, and frequently less right-of-way acreage is required. In addition, land clearing costs may be reduced because the new system(s) may be able to utilize part of an already cleared right-of-way.

d. Social Considerations

A decision to require joint use on Federal lands would, in most cases, dictate the location of the right-of-way on adjoining non-Federal lands. This may serve to concentrate adverse impacts on private land, and, if ownership of relatively small land parcels is involved, it could require total taking of properties and relocation of the residents and developments. Review and participation by all interested parties is needed to minimize uncompensated social inequities that accompany unilateral joint-use decisions.

Furthermore, private lands abutting or intermingled with Federal lands are often of different character than the Federal lands. For example, some private land in arid areas is adjacent to live water courses; agricultural land abutting Federal lands represents an abrupt change in land-use. And, some private lands have the potential for being subdivided into homesites. Consequently, taking these property rights for rights-of-way may limit the development potential of the private lands, hence this should be considered, along with legal ramifications, when making joint-use decisions.

e. Reliability Considerations

Joint use may reduce the reliability of the systems involved. The impact on reliability through disruption of service increases as distance between systems narrows. Maintaining uninterrupted service is an important goal of all systems, but particularly for electric, communications, and natural gas pipelines. Service disruptions in electrical systems and communications can cause system overloads in other portions of the network resulting in cascading outages. Pipeline systems also suffer when there is little or no storage or interconnection to other pipelines.

Where disruption of service by electric, communication, and pipeline systems can be demonstrated by simulation to have wide-spread and/or cascading effects and close systems proximity can be shown to increase the likelihood of disruption, joint use should allow sufficient space between systems or improved design to achieve adequate levels of reliability.

f. Safety Considerations

Joint use also increases opportunities for hazards such as electrical shocks and interference with normal traffic flow on highways and railroads. Safety during construction and operation must be provided in joint-use situations through adequate spacing between systems and adoption of stringent safety practices. To avoid safety problems, a free flow of safety information among systems engineers must be established prior to joint-use decisions. The degree of pre-planning needed increases as the space between systems decreases.

g. Legal Considerations

Recent changes in legal authority for granting rights-of-way support the joint-use concept where feasible and practical. P.L. 93-153, amending section 28 of the Mineral Leasing Act of 1920, supports joint-use (common-use) practices for oil and gas pipelines by stating that:

In order to minimize adverse environmental impacts and the proliferation of separate rights-of-way across Federal lands, the utilization of rights-of-way in common shall be required to the extent practical
. . . (emphasis added).

The National Environmental Policy Act of 1969, in its required assessment of the environmental, economic, and social impacts of a project proposal, provides for an assessment of the alternatives, such as joint-use possibilities. The most recent legislative proposal for the Bureau of Land Management, cited as the "National Resource Lands Management Act," contains language directing the use of rights-of-way in common "to the extent practical."

Legal considerations of the utility and transportation industries concern, among other things, the control of the rights-of-way, financing, and liability considerations. An easement will provide sufficient property rights if complete control of all surface rights is not required for the safe and efficient operation of the system. A requisite of the easement is acquisition of sufficient property rights to control conflicting land use and practices without interfering with the construction and operation of the system. The right of access to and use of the right-of-way for maintenance is particularly important. Fee title is required when complete control of rights-of-way is needed, such as for railroads and highways where practically all other previous uses interfere with operation of the system.

The legal aspects of industry financing arise from the fact that investor-owned utilities raise the necessary capital for plant additions through a mix of debt and equity financing. In order to satisfy the requirements of the lenders, the utility must secure sufficient rights to certify that the facilities constructed will remain in place for an extended period of time without undue risk of having to abandon the location. Furthermore, control of the right-of-way in regard to other uses permitted is an important legal aspect in terms of determining liability in the event of a lawsuit. The complexities of joint-use situations would tend to complicate each company's control of its portion of the corridor in terms of financing and liability. In addition, a variety of questions involving legal rights can be expected concerning required joint use of the right-of-way.

By requiring joint use, Federal Agencies may be placed in a position of mediating compliance agreements among users: for example, disputes between companies over road maintenance responsibilities and cost sharing.

h. National Security Considerations

This study found that joint use increases the vulnerability of transportation and utility systems to acts of war. Review by modeling indicates that fewer nuclear or conventional weapons are needed to destroy a joint-use arrangement as compared to dispersed rights-of-way. (Aerospace Corporation, 1975)

Joint use, too, increases susceptibility to "bonus kill" through sabotage of one system resulting in disruptions to others. On the other hand, joint use would be easier to physically protect through surveillance, patrol, access control, or other measures.

The desirability of locating rights-of-way to protect the systems and reduce their vulnerability depends on the strategic importance of the systems and the specific situation.

3. Findings

- ° A national system of planning corridors is desirable. Implementation of a planning corridor requires the development of a complete data base, a land use plan, and coordination between all levels of government, industry, and the public.
- ° The desirability of joint use can only be determined for specific situations through identification and analysis of the variables involved and associated trade-offs.
- ° Early planning for future right-of-way locations is desirable because of proposed energy development projects and current trends in Federal land use and resource decisions that tend to limit right-of-way use.
- ° Coordinated and planned locations or proposed or projected rights-of-way across Federal land will minimize the loss of natural resources within or adjacent to the rights-of-way and avoid unnecessary environmental degradation.

APPENDIX A

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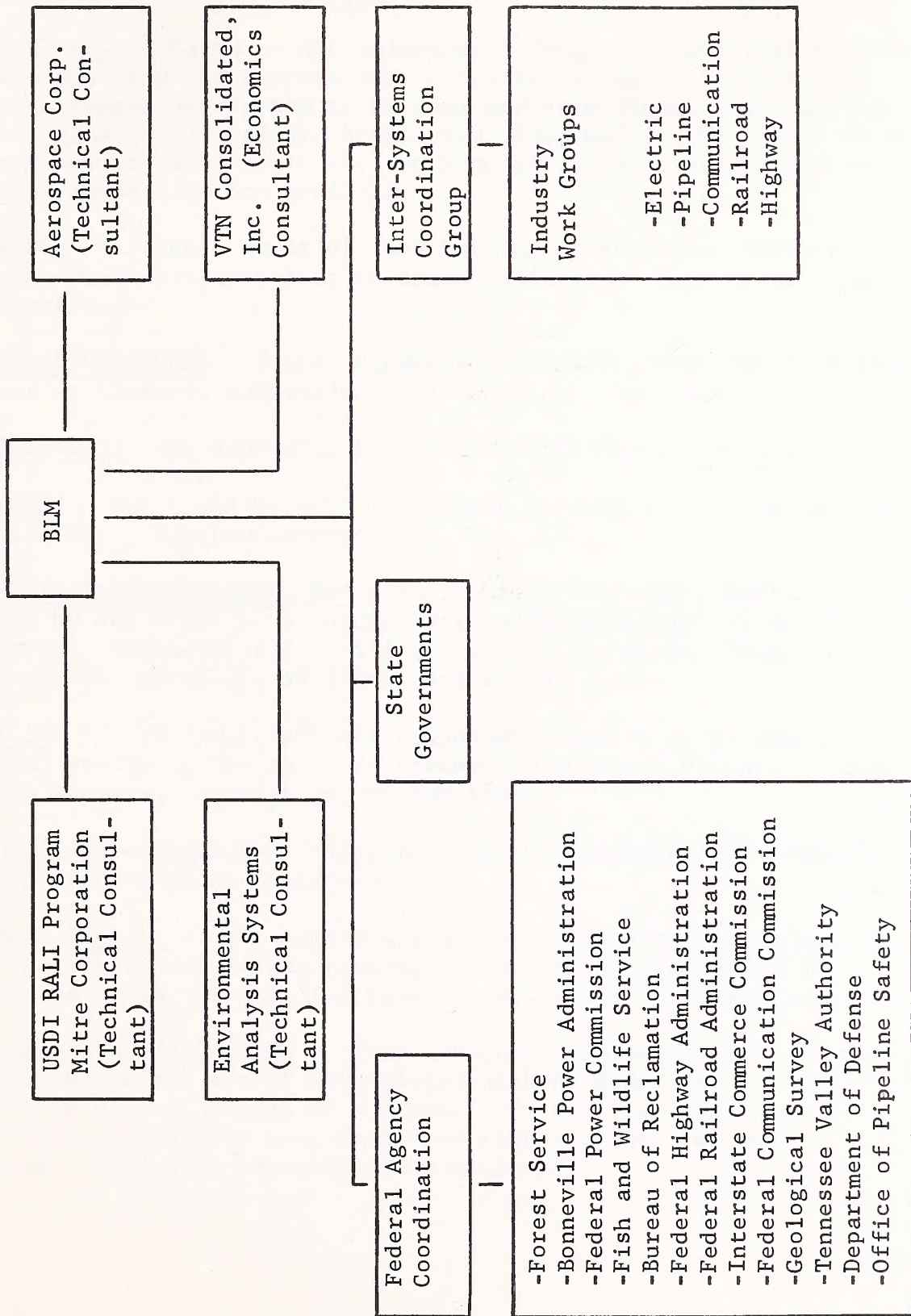
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NOTE: Numerous other publications, periodicals, and references were researched in this study. The above lists only the principal data references referred to in this report.

APPENDIX B

TRANSPORTATION AND UTILITY CORRIDOR STUDY ORGANIZATION CHART



APPENDIX C

GLOSSARY OF TERMS

COMMON USE - Same as JOINT USE

COMMUNICATION SYSTEM - All telephone, telegraph, and other methods of transmitting information over lines or cables of 100 miles or more in length considered to be long distance signal transmission lines, plus all associated facilities, components, and rights-of-way. Microwave, radio, television, and satellite transmissions not carried by a physical line are excluded.

CORRIDOR - A linear strip of land forming a passageway between two points in which transportation and/or utility systems exist or may be located.

CULTURAL RESOURCES - Sites, structures, objects, and districts significant in history, architecture, archaeology, or culture.

DESIRABILITY - An advisable or recommendable course of action.

EASEMENT - The right held by one person to make use of the land of another for a limited purpose.

ELECTRIC TRANSMISSION SYSTEM - An existing overhead powerline(s) of 115 KV and above or a future overhead powerline(s) of 230 KV and above, including all facilities within the right-of-way, all substations, switching stations, and access roads.

FACILITY - All structures and components used by a transportation or utility system to transport or transmit electrical energy, communication signals, commodities, or services.

FEASIBILITY - Capable of being done or accomplished, particularly from a technological standpoint.

FEDERAL AGENCY - Any regulatory or administrative branch of the Federal Government having responsibility in the regulation or operation of any of the five transportation and utility systems.

FEDERAL HIGHWAY PROJECTS - Those projects administered by a State which involve the use of Federal-aid highway funds for the construction or improvement of a Federal-aid highway or related facilities or for the acquisition of rights-of-way for such purposes, including beautification projects.

FEDERAL LANDS - For the purpose of this study, all lands owned by the United States except lands in the National Park System, lands held in trust for an Indian or Indian tribe, and lands on the Outer Continental Shelf.

FEE TITLE (relating to land ownership) - Transfer of all rights, title, and/or interest held by the grantor subject to any reservations the grantor may retain as specified in the granting document.

HIGHWAY SYSTEM - All roads designated as interstate or primary highways.

JOINT USE - Operating facilities of the same or different systems placed parallel to each other in as close proximity as practical. If more than one right-of-way is involved they may overlap entirely or partially, be adjoining, or separate.

JOINT-USE CORRIDOR - A narrow strip of land with restricted boundaries in which facilities of the same or different systems are placed adjacent to each other in as close proximity as practical and feasible.

JOINT USE OF RIGHTS-OF-WAY - Same as JOINT USE.

LAND-USE PLANNING - The process in which systematic inventories are made to identify environmental and resource values; the conflicts between various uses or management objectives are identified; and goals and objectives are established for protection of critical resource and environmental values and guidance of development plans and/or management objectives.

MITIGATE - To make less severe; attenuate.

NATIONAL SYSTEM OF TRANSPORTATION AND UTILITY CORRIDORS - Federal policy pertaining to highway, railroad, pipeline, electric transmission, and communication systems located or planned to be located across Federal lands.

NEED - An action deemed necessary in the interests of the Nation.

PIPELINE SYSTEM - Pipe, pumping stations, and all associated facilities needed to transport oil, gas, water, and coal between central gathering points and points of distribution.

PLANNING CORRIDOR - A broad linear strip of land, of variable width reserved between two geographic points, which has ecological, technical, and/or economic advantages over adjacent areas for the location of transportation and/or utility systems.

PROLIFERATION - Excessive, rapid spread.

PUBLIC DOMAIN - Original public lands which have never left Federal ownership; also, lands in Federal ownership which were obtained by the Government in exchange for public lands or for timber on such lands; also, original public domain lands which have reverted to Federal ownership through operation of the public land laws.

RAILROAD SYSTEM - All mainline railroad tracks of 100 miles or more in length, all rail extensions or additions of ten miles or more in length, and all associated facilities, components, and rights-of-way of all Class I railroads, with an annual revenue of \$5 million or more, operating within the United States.

RELIABILITY - The combination of effects on a facility's capability to efficiently and effectively maintain continued service relevant to the probability and consequences of service disruptions.

RIGHT-OF-WAY - The legal right for use, occupancy, or access across land or water areas for a specified purpose or purposes. Such use on Federal land is authorized by permit, lease, easement, or license. On patented lands, it is acquired by easement or purchase.

SAFETY - Relative to the danger that may exist for sustaining property damage or personal injury.

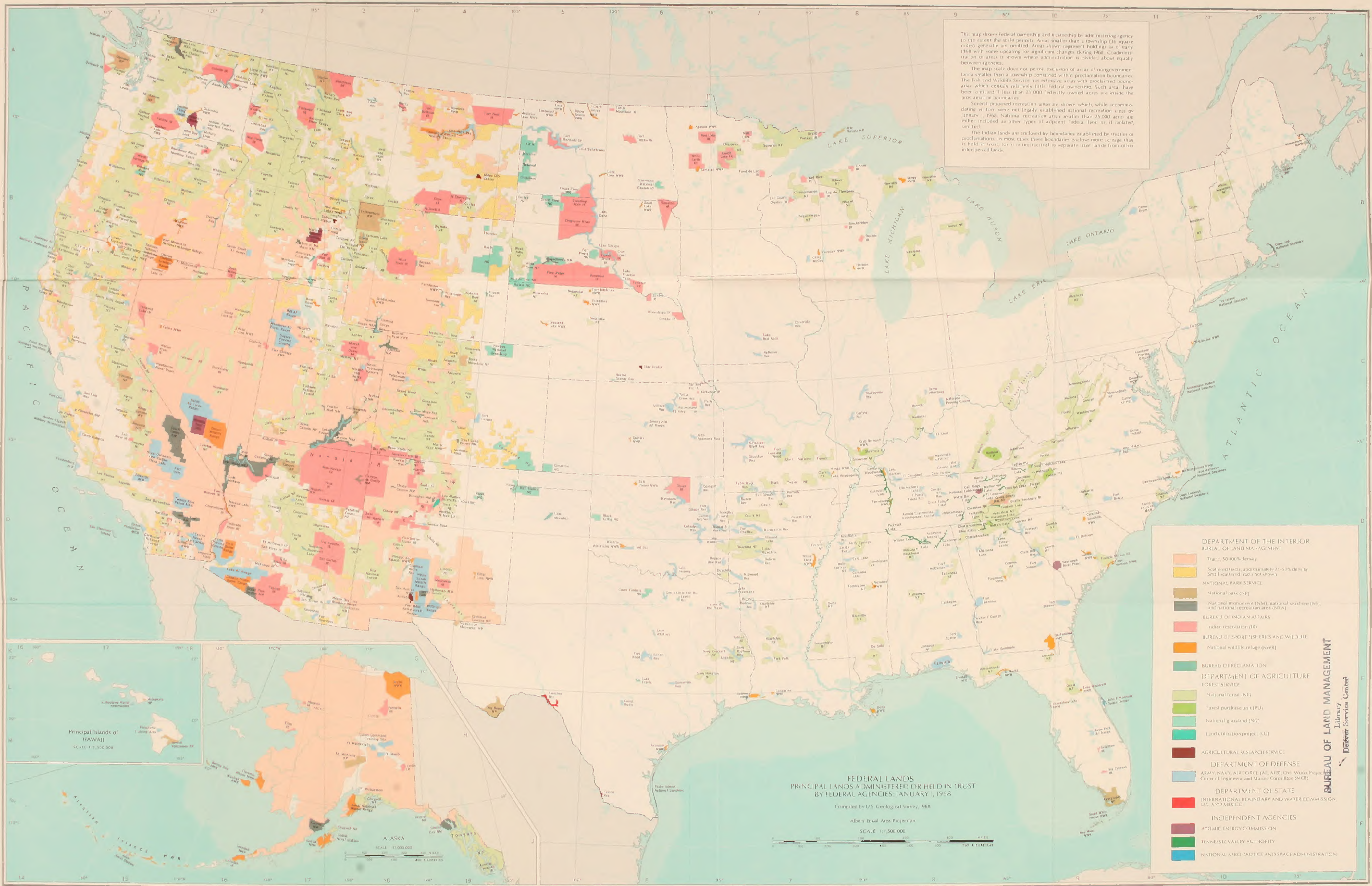
SHARED USE - More than one use of the same or overlapping rights-of-way.

SYSTEMS - Individual and/or collective electrical transmission, pipeline, non-microwave communication, highway, and railroad facilities. These may consist of individual lines, routes, or facilities but for simplicity of discussion are referred to collectively. A system is not necessarily an interconnected network, though in many instances it is.

UTILITIES - Includes all privately, publicly, or cooperatively owned lines, facilities, and systems for producing, transmitting, or distributing communication signals, electrical energy, or petroleum and fossil fuel products.

WESTERN STATES - Those States located west of the 100th Meridian, including Alaska, but excluding Hawaii.

WHEELING - One utility company or agency transmitting electrical energy over the facilities of another company or agency.



This map shows Federal ownership and trusteeship by administering agency to the extent the scale permits. Areas smaller than a township (36 square miles) generally are omitted. Areas shown represent holdings as of early 1968, with some updating for significant changes during 1968. Co-administration of areas is shown where administration is divided about equally between agencies.

The map scale does not permit exclusion of areas of nongovernment lands smaller than a township contained within proclamation boundaries. The Fish and Wildlife Service has extensive areas with proclaimed boundaries which contain relatively little Federal ownership. Such areas have been omitted if less than 25,000 Federal-owned acres are inside the proclamation boundaries.

Several proposed recreation areas are shown which, while accommodating visitors, were not legally established national recreation areas by January 1, 1968. National recreation areas smaller than 25,000 acres are either included as other types of adjacent Federal land or, if isolated, omitted.

The Indian lands are enclosed by boundaries established by treaties or proclamations. In most cases these boundaries enclose more acreage than is held in trust, for it is impractical to separate trust lands from other interpermed lands.

FEDERAL LANDS
PRINCIPAL LANDS ADMINISTERED OR HELD IN TRUST
BY FEDERAL AGENCIES: JANUARY 1, 1968

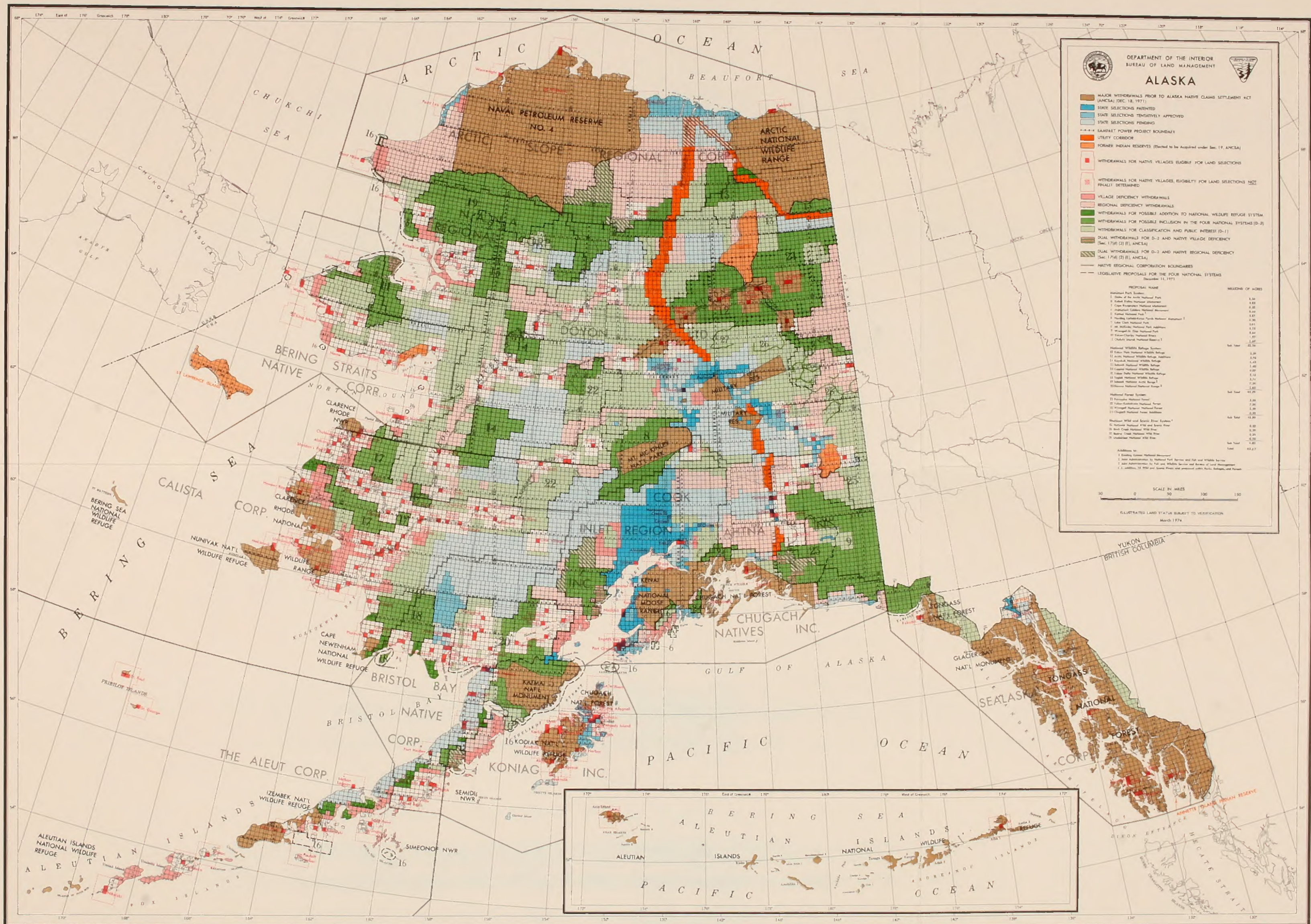
Compiled by U.S. Geological Survey, 1968

Albers Equal Area Projection

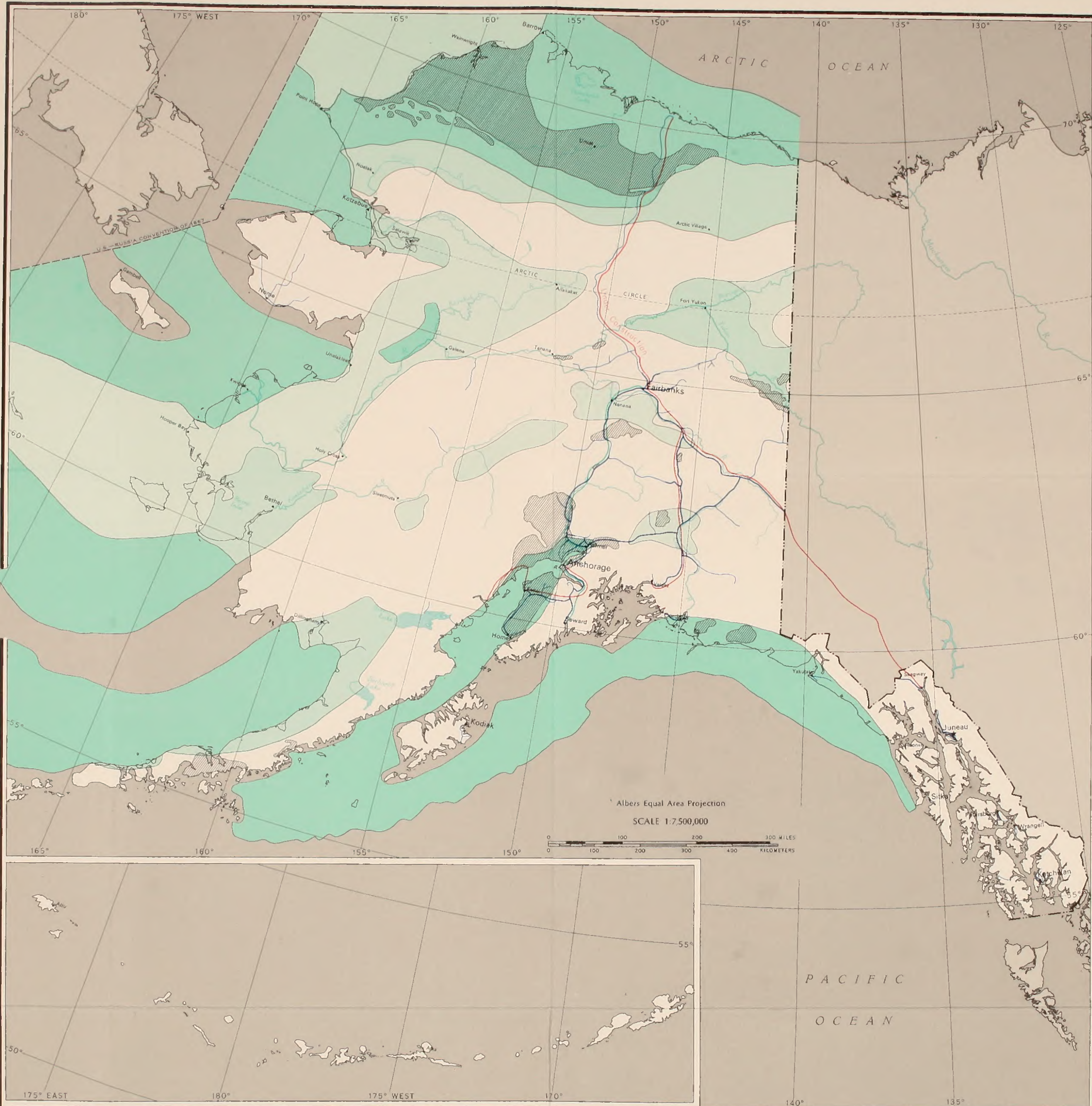
SCALE 1:7,500,000

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TITLE I.P.L. 93-153 TRANSPORTATION AND UTILITY
CORRIDOR STUDY JULY 1, 1975



DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
TITLE I P.L. 93-153 TRANSPORTATION
AND UTILITY CORRIDOR STUDY
JULY 1, 1975



ALASKA

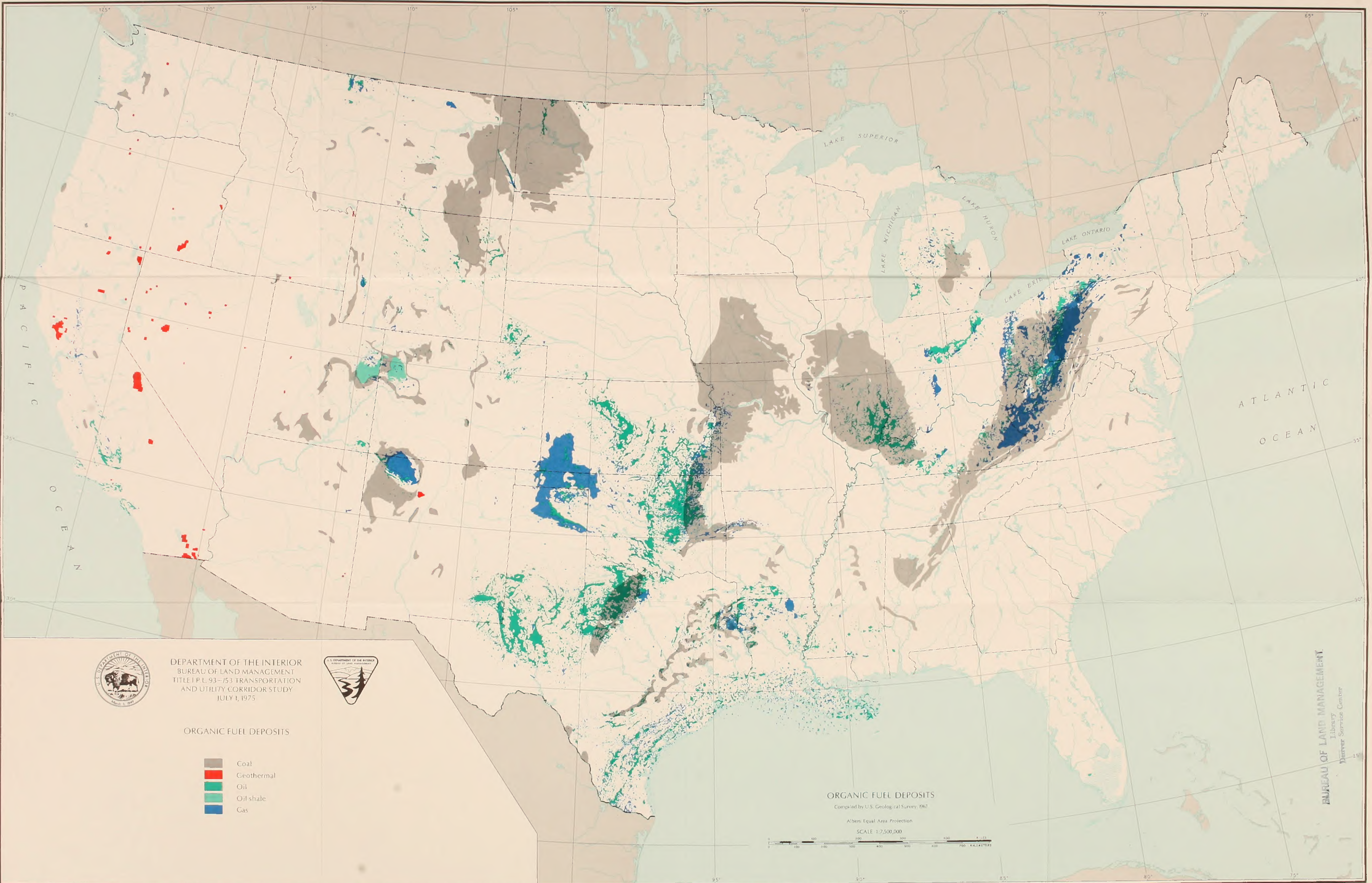
EXISTING RIGHTS-OF-WAY SYSTEMS

- Federal-aid primary highways
- Gravel roads of major significance
- Railroads
- Pipelines

ORGANIC FUEL DEPOSITS

- Petroleum reserves
- Rank I—highest reserves
- Rank II
- Rank III—lowest reserves
- Coal deposits

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BUREAU OF LAND MANAGEMENT
TITLE I P.L. 93-153 TRANSPORTATION
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JULY 1, 1975



ORGANIC FUEL DEPOSITS

- Coal
- Geothermal
- Oil
- Oil shale
- Gas

ORGANIC FUEL DEPOSITS

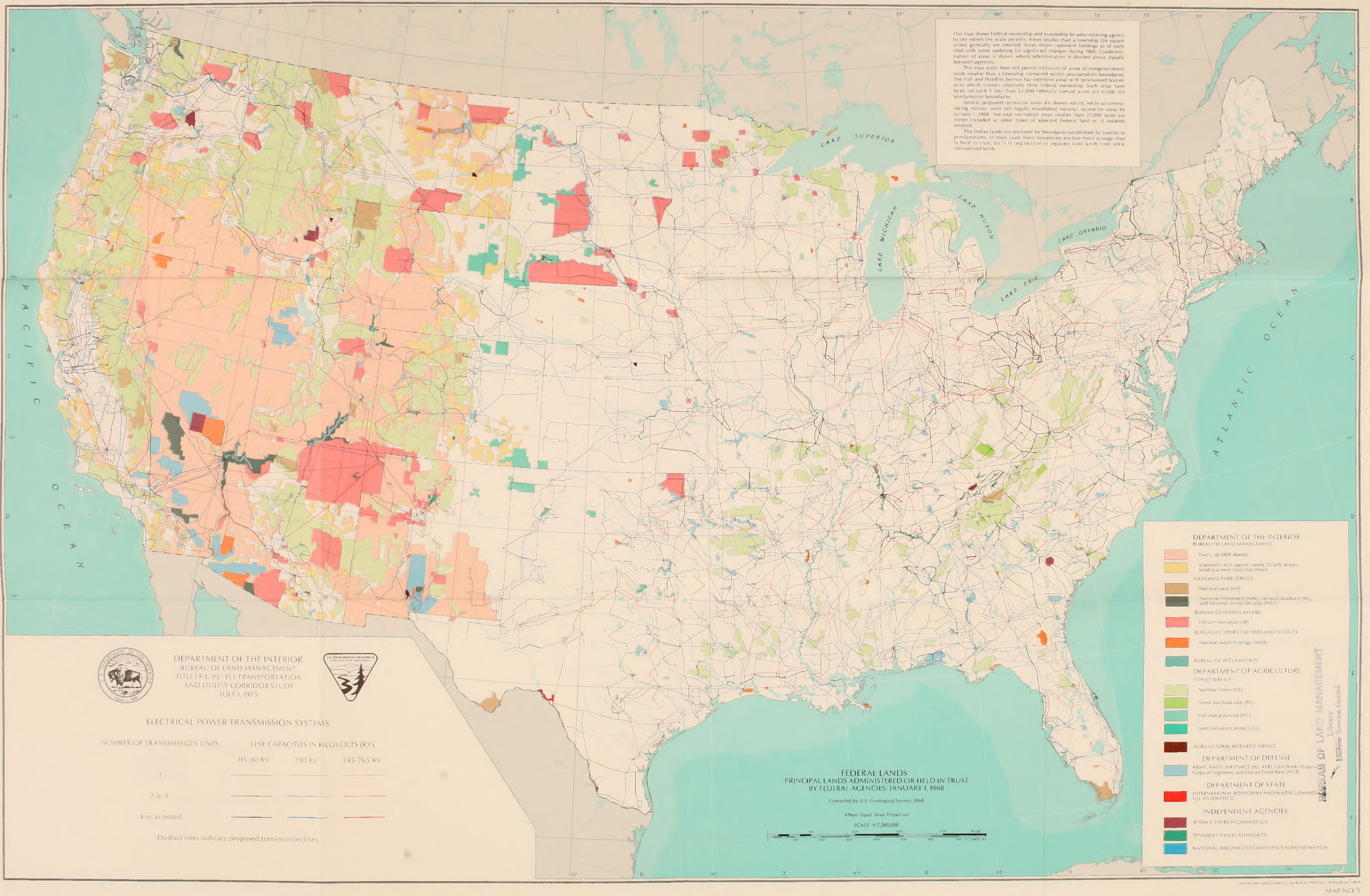
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Albers Equal Area Projection

SCALE 1:7,500,000



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TITLE I P.L. 93-153 TRANSPORTATION
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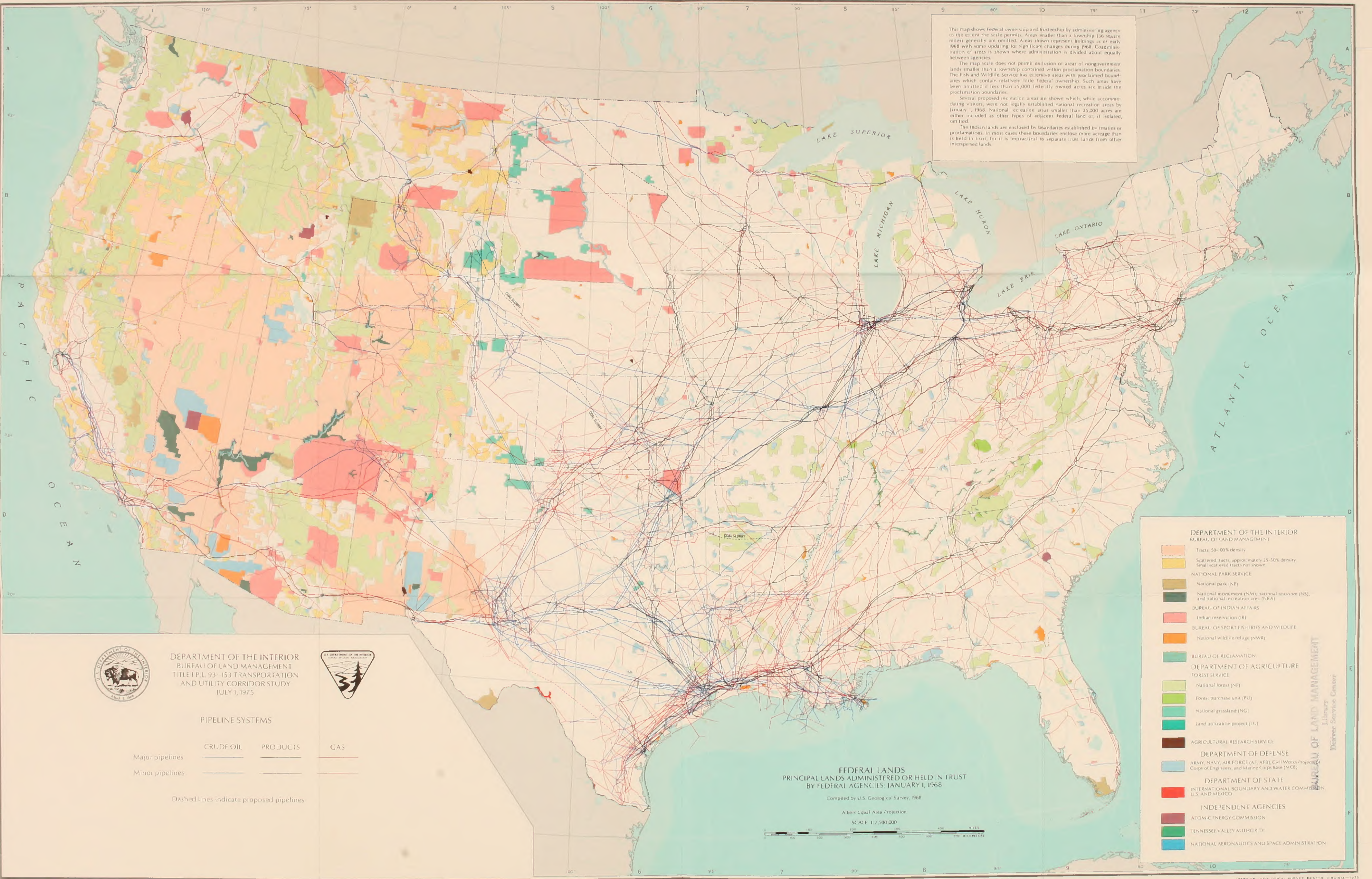
ELECTRICAL POWER TRANSMISSION SYSTEMS

NUMBER OF TRANSMISSION LINES	LINE CAPACITIES IN KILOVOLTS (KV)		
	115-161 KV	230 KV	345-765 KV
1			
2 or 3			
4 or as noted			

Dashed lines indicate proposed transmission lines

FEDERAL LANDS
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0 100 200 300 400 500 600 700 800 900 1000 MILES
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JULY 1, 1975



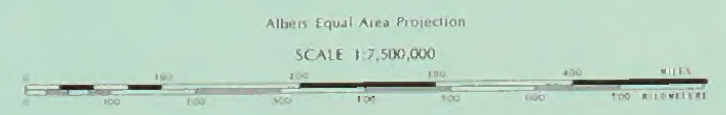
PIPELINE SYSTEMS

	CRUDE OIL	PRODUCTS	GAS
Major pipelines			
Minor pipelines			

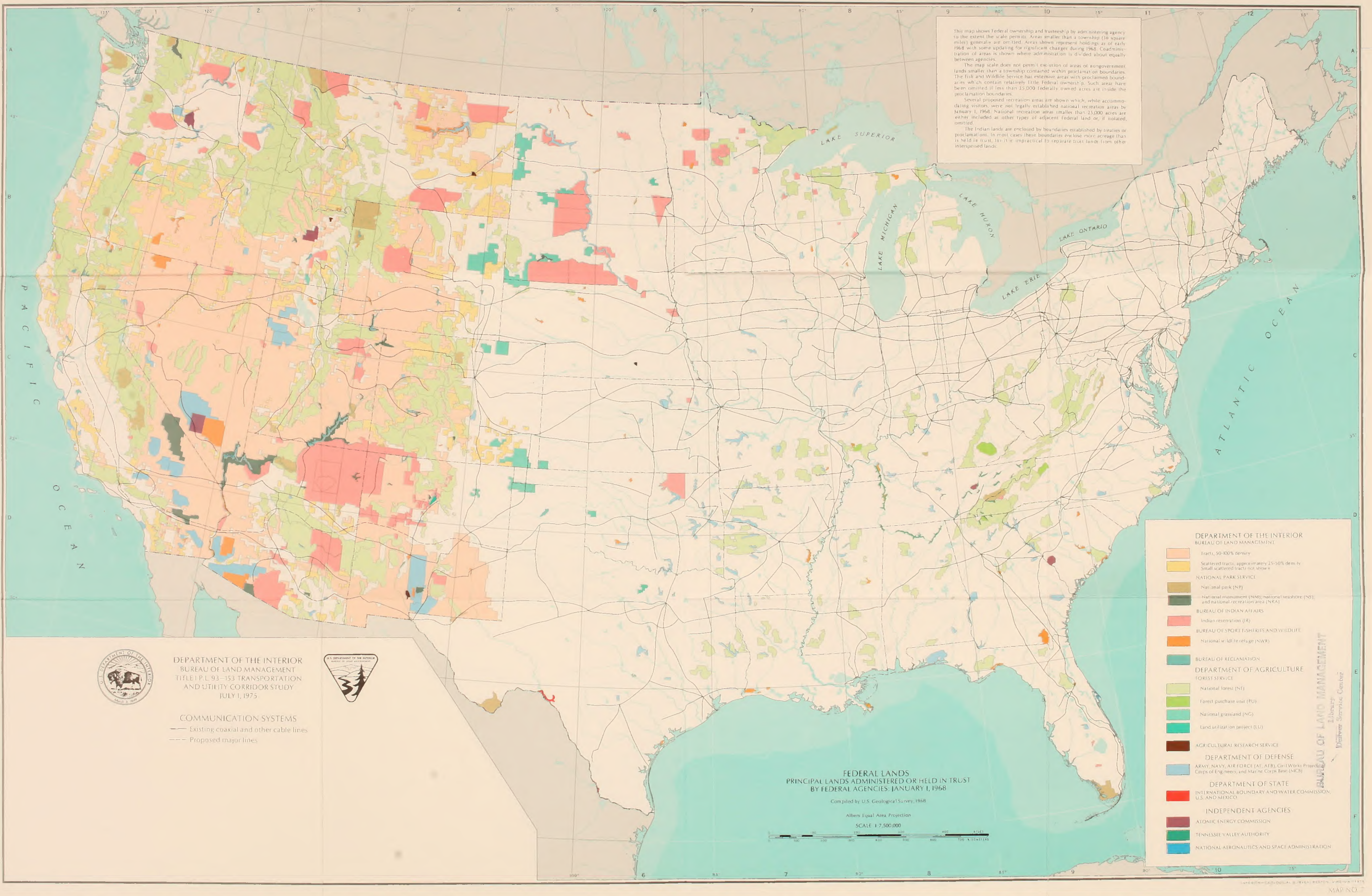
Dashed lines indicate proposed pipelines

FEDERAL LANDS
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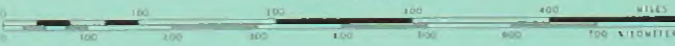
COMMUNICATION SYSTEMS
— Existing coaxial and other cable lines
--- Proposed major lines

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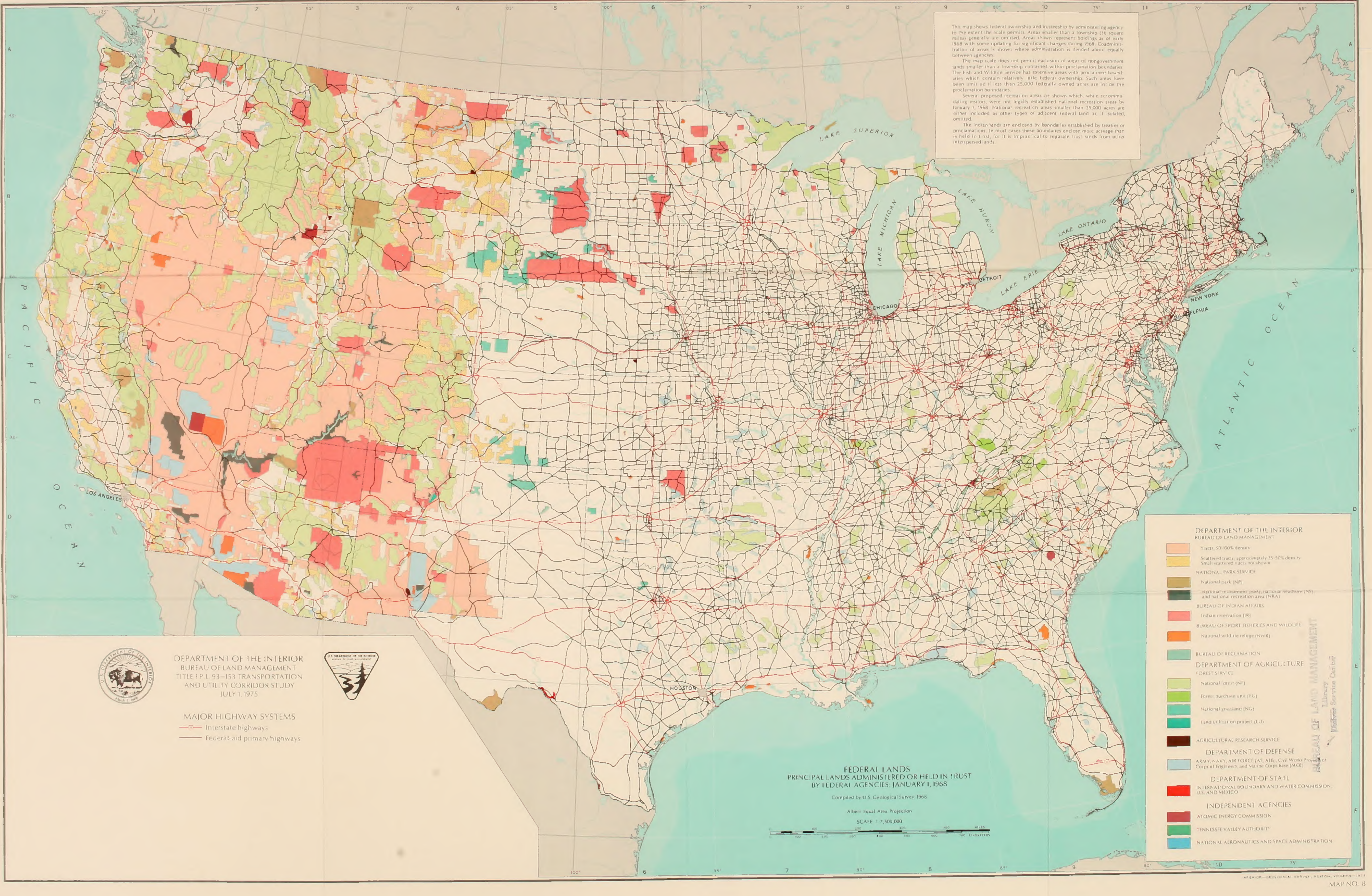
Albers Equal Area Projection

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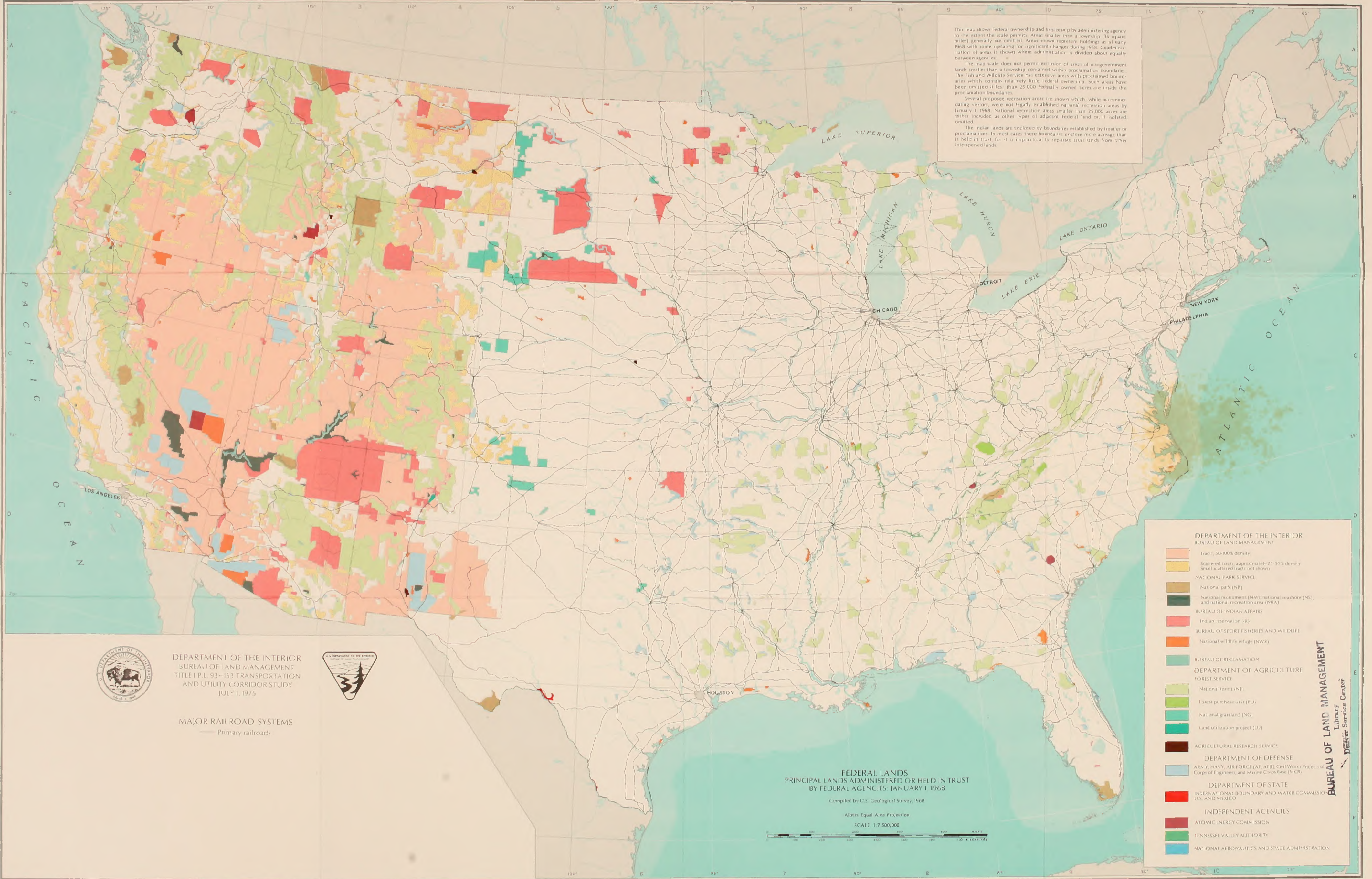


MAJOR HIGHWAY SYSTEMS
— Interstate highways
— Federal-aid primary highways

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MAJOR RAILROAD SYSTEMS
— Primary railroads

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